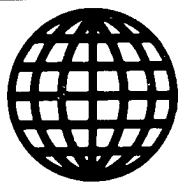


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# ***JPRS Report***

# **Science & Technology**

***Japan***

CURRENT STATUS OF SCIENCE & TECHNOLOGY AGENCY

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SCIENCE & TECHNOLOGY  
JAPAN

CURRENT STATUS OF SCIENCE & TECHNOLOGY AGENCY

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## Introduction: Role of the Science and Technology Agency

The role of the Science and Technology Agency [hereafter referred to as the S&T Agency] is to promote development of science and technology and to foster overall administration concerning S&T in order to contribute to the growth of the national economy. The S&T Agency performs the following functions:

- 1) Plans, drafts and promotes basic policies concerning S&T.
- 2) Coordinates overall management affairs conducted by S&T-related government agencies.
- 3) Coordinates cost estimate policies of S&T-related government agencies.
- 4) Promotes research and development [R&D] projects requiring joint effort by various government agencies.
- 5) Promotes large-scale R&D that should be conducted on a unified basis, in addition to common and basic R&D that transcend the framework of individual government agencies (e.g., nuclear energy, space, oceans, life sciences and materials).
- 6) Upgrades the R&D promotional base commonly required by the various government agencies.
- 7) Reviews policies pertaining to overall use of resources.
- 8) Investigates and analyzes foreign and domestic S&T trends.
- 9) Manages affairs of nine councils and committees that deliberate on basic and comprehensive national policies, such as the Council for S&T, the Japan Atomic Energy Commission [Japan AEC], the Space Activities Commission and the Nuclear Safety Commission.

## **I. PROMOTES INTERNATIONAL CONTRIBUTIONS IN S&T AREAS**

### **1. Promotes International Cooperation**

#### **(1) Need for International Contribution**

As Japan's international position and S&T standards rise, active international contribution is demanded in S&T areas as well.

Particular need for international cooperation has risen in the following aspects: 1) basic research to achieve scientific results as common assets for mankind; 2) space and nuclear energy that require huge facilities and equipment; 3) earth and ocean S&T that necessitate coping on a global scale; and 4) the areas of environment and sanitation that involve interests common to mankind.

#### **(2) Promotional System for International Cooperation**

##### **(Bilateral Cooperation)**

Cooperative activities have been promoted in the past based on a scientific and technological cooperation agreement. A new Japan-U.S. agreement was signed in June 1988, a Japan-Italy agreement was signed in October of the same year, and a new framework of cooperation is being implemented. Joint committees on S&T, based on the agreements, and reviews on joint research and promotional measures on future cooperative projects are being conducted. Also, views are exchanged with the European Community [EC], China and South Korea on the ministerial level concerning cooperation in S&T fields.

##### **(Multilateral Cooperation)**

The Human Frontier Science Program [HFSP] to promote basic research within an international framework will be implemented on a full-fledged scale beginning in FY89. In addition, cooperation in the S&T areas is being promoted in numerous forums such as the United Nations, the Organization for Economic Cooperation and Development [OECD] and the Asian Scientific Cooperation Alliance [ASCA].

#### **(Others)**

Cooperation with the developing nations is conducted through the Japan International Cooperation Agency [JICA], in addition to cooperation within the aforementioned bilateral and multilateral frameworks.

#### **(3) Promotes Talent Exchange**

Researchers at national experimental research institutes are sent abroad to enhance their competence and contribute to international S&T exchange. In addition, efforts are made to expand research exchange through various systems.

Also, the fellowship system established in FY88 to accept young foreign researchers at Japan's national experimental research institutes is being expanded further.

Furthermore, in 1989, the Research Development Corporation of Japan was reorganized to upgrade the promotional system for comprehensive and efficient exchange of international research.

Also, dormitories for foreign researchers are being built, and Japanese-language training is provided, recognizing that smooth acceptance of foreign researchers is also important for the promotion of talent exchange.

Additionally, based on the Research Exchange Promotion Act, a path has been opened for promotion of foreign researchers as research government employees at division and section-chief levels. As of March 1989, three foreign researchers were working as research government employees.

#### **(4) Promotes Informational Exchange**

Based on the Japan-U.S. S&T agreement, a subcommittee was established to promote use of S&T information in the two nations, and it is presently conducting reviews. Also, S&T information has been designated as a sector of cooperative projects in Japan-West Germany and Japan-France bilateral cooperation.

In addition, the Japan Information Center for Science and Technology [JICST] operates the S&T Network International [STN International], which was established in cooperation with West German and American institutions. It also implements the ASCA S&T informational cooperation project for participating nations of the ASCA.

#### **(5) Promotes Joint Research**

Regarding the promotion of joint research, cooperation is urged in the fields of the space station and nuclear fusion. Also, since FY87, promotional and coordination funds have been used to conduct key international joint research in order to promote research cooperation based on the aforementioned bilateral S&T cooperation agreements.

## **(6) Others**

In promoting basic and creative S&T, research is conducted by teams that include foreign researchers under the "creative S&T promotion system" (Research Development Corporation of Japan) and the "International Frontier Promotional System" (Institute of Physical and Chemical Research), recognizing the importance of mutual stimulation among researchers with different ideas.

### **<Reference>**

#### **Outline of S&T Agency's Fellowship System**

The purpose of this system is to accept foreign researchers at national experimental research institutes in order to promote international research exchange in the S&T fields.

#### **Content of Fellowships**

- 1) Number of fellowships: 130 new researchers in FY89
- 2) Qualification: Centered on young researchers from the advanced nations (with a PhD)
- 3) Benefits:
  - (1) Living expenses, air travel expenses, family allowances, housing allowance and in-Japan travel allowance
  - (2) Japanese-language training, housing assistance and counseling on life in Japan
- 4) Period of stay: About 6 months to 2 years.

#### **2. Promotes Human Frontier Science Program [HFSP]**

Japan took the initiative for the Human Frontier Science Program, which is a concept to promote basic research through joint international efforts centered on elucidation of the superior functions of organisms.

##### **a. Background of Program Proposal**

It is important for Japan, which has assumed a major position in the international society not only in the economic aspect, but also in the S&T aspect, to contribute aggressively in the future to the international society by promoting not only practical technology, but also creative and basic research to produce seeds for growth in the new era.

Meanwhile, the functions of organisms have obtained a variety of superior properties through the process of biological evolution over several billions of years. If the intricate and precise mechanisms of the biological func-

tions can be elucidated through today's advanced S&T, it will open new and epochal domains that contribute to S&T progress, and their application and use will mean an unlimited boon for mankind.

With this as a background, surveys and studies for the Human Frontier Science Program got underway with the cooperation of the S&T Agency, centering on the Council for S&T and other government agencies concerned (the Ministry of International Trade and Industry, Ministry of Education, Ministry of Health and Welfare, Ministry of Agriculture, Forestry and Fishery, Ministry of Posts and Telecommunications, and Ministry of Foreign Affairs).

#### **b. Proposal and Promotion of the Program at the Venice Summit**

The program was proposed at the Venice Summit in June 1987 by former prime minister Nakasone. Japan's initiative won high praise, and the proposal was mentioned in the economic declaration.

Also, at the Toronto Summit in June 1988, Prime Minister Takeshita reported on the findings of a feasibility study. He also expressed Japan's determination for an early materialization of the program. Expectation regarding Japan's proposal to implement the program was mentioned in the economic declaration.

#### **c. Program Implementation**

It was decided to start the program with Japan's initiative in FY89 as follows:

- 1) Establish a corporation in Europe as the core implementing organization for the program.
- 2) The Japanese government will provide necessary funds for project implementation in FY89 by the corporation.
- 3) Projects such as research grants, fellowships, workshops and the collection and distribution of related data will begin under international management.

In addition, preparatory activities have been evolving aggressively since the fall of 1988 to facilitate a smooth start in FY89. Concretely, missions led by members of the Council for S&T are being sent to Europe and North America to solicit cooperation and exchange views in the nations concerned.

Also, international conferences are held, attended by scientists from those nations to conduct in-depth reviews of contents of the projects proposed under the program.

#### **<Reference>**

Research grants--Subsidies for international joint research teams centered on young researchers.



Fellowships--Subsidies for travel and living expenses incurred by young researchers while conducting research outside their countries.

Workshops--Assistance toward international research meetings to exchange information and to deliberate on advanced research findings.

## II. ENHANCES CREATIVE AND BASIC RESEARCH

### 1. Basic Science Special Researcher System

Development of richly creative S&T is indispensable for Japan to build an affluent society and contribute in the future to the international society with radical S&T development. However, in the past, Japan's research system was generally goal-oriented under lifetime employment and seniority. It guaranteed personal security, but has been criticized for lack of an environment providing full expression to individuality and full development of one's capability. In view of this situation, a special researcher system for basic science will be established as a new measure in FY89 under joint sponsorship of the S&T Agency and the Institute of Physical and Chemical Research.

This system provides opportunities for outstanding young researchers with high originality to conduct research freely and independently. It is a system whereby they can fully manifest their creativity and become active pillars for basic development, and the system will be implemented as a link in the policy to enhance basic research. Also, in implementing the system, Japan's double purpose is to obtain conditions and realization measures for optimum research environment, in which basic research can be effectively promoted in Japan.

In implementing the system the S&T Agency will be in charge of selecting special researchers for basic science and system evaluation. The Institute of Physical and Chemical Research will receive the selected special researchers, and promote themes proposed by the special researchers as a link in the institute's research projects.

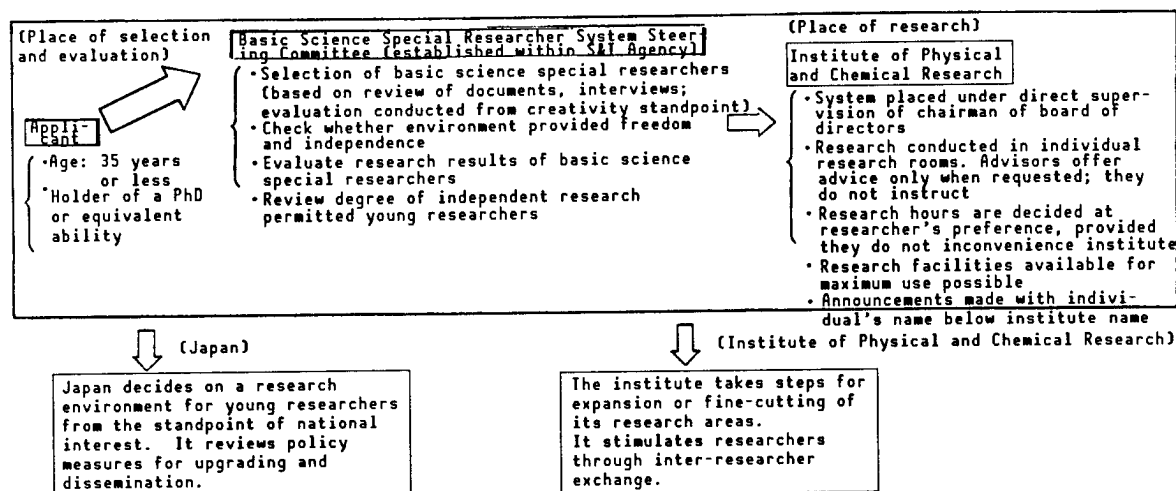
Qualifications required of special researchers for basic science are as follows: Researchers 35 years of age or less with a PhD or an equivalent capability; a potential as outstanding researchers with rich creativity and the desire to promote research themes voluntarily at the Institute of Physical and Chemical Research in physics, chemistry, engineering, biology or a border discipline.

Selections will be made by the Basic Science Special Researcher System Steering Committee (temporary title) established within the S&T Agency. Detailed application procedures and selection methods are yet undecided, but it is planned to accept 25 researchers a year.

Treatment and conditions for the conduct of research will be decided by a contract between the institute and the selectee, who will be able to conduct research independently for a maximum of 3 years, using the institute's

facilities. He will be able to engage in research activity during hours of his own choice, provided they do not inconvenience the institute's operations, and he will be able to participate freely in symposiums and research meetings conducted by the institute. The institute will thus respect the independence of the special researcher as much as possible. Also, in case of a new discovery of the special researcher, patent rights will be shared with the institute.

#### <Reference>



## 2. Creative S&T Promotional System

It is important for Japan to produce original and innovative technology in order to build an affluent society headed for the 21st century, and to contribute to the international society.

Toward that end, the S&T Agency established a "creative S&T promotional system based on a fluid research system" in FY81, with the purpose of fully demonstrating the creativity of researchers and germinating seeds of innovative technology, and it is presently conducting probing research.

Today, research is underway on 12 projects, including research on "special environment microbes."

#### <Outline of Research System>

(1) Steering organization: Research Development Corporation of Japan

(2) Basic operations:

- Grants discretionary power concerning research operations within a defined scope to an outstanding leader (a person with overall responsibility), and promotes overall research under his guidance.

- Gathers superior researchers from overseas to industrial, academic and government institutions, and conducts research under a human-centered system that focuses on the use of human creativity.
- Conducts flexible management that provides for adaptive changes of research goals in accordance with progress circumstances.
- Conducts research by utilizing, in principle, facilities in the private sector.

### (3) Person with overall responsibility

A person with in-depth understanding of research themes, who can accurately evaluate researchers, and who has a manager's capacity to organize research, will be selected as the person with overall responsibility.

### (4) Research scale

A single project will include an average of three to four research groups (each consisting of about five researchers).

Also, research spending per project is expected to total about ¥2 billion for a 5-year period.

### (5) Handling of research results

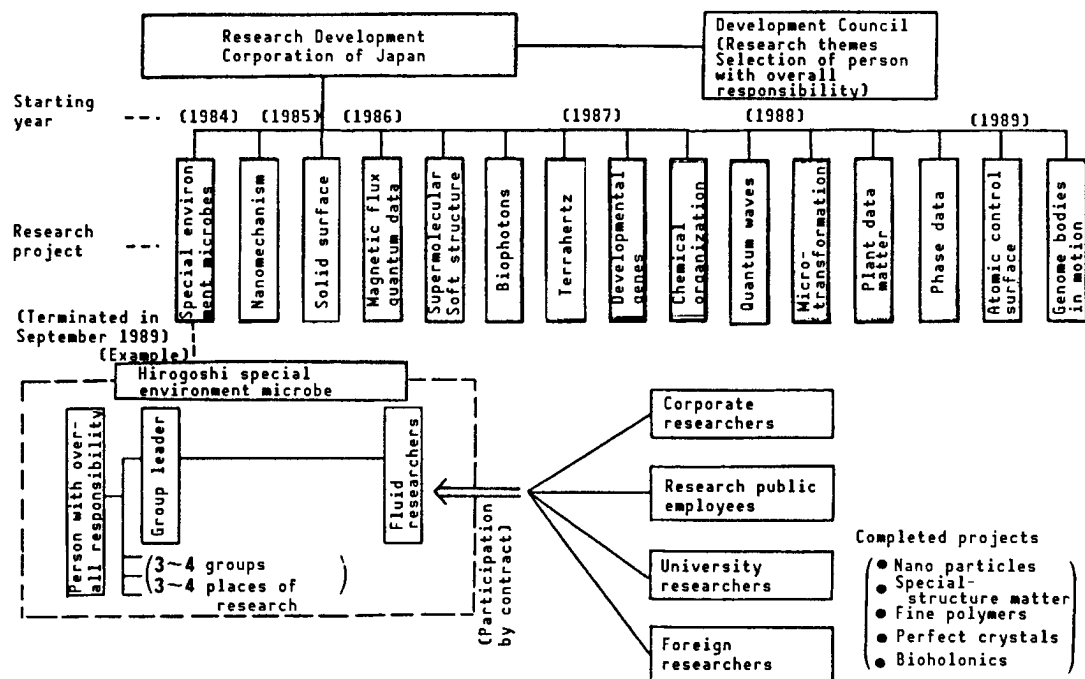
Research results such as patents will be shared by the corporation and the individual inventor (discoverer). (After the research is terminated, patent transfer from the inventor to his affiliated or dispatching institute is possible.)

## 3. International Frontier Research System

S&T is making remarkable strides today, thus contributing to progress in the social economy. However, in view of the advancement and complexity of S&T itself, the discovery of new knowledge has become an important key to a breakthrough for a new era in which to build an affluent society in the 21st century.

Consequently, with the aim of gathering researchers from many domains, the S&T Agency established an international frontier research system within the Institute of Physical and Chemical Research in October 1986. The purpose is to conduct "frontier research" or advanced basic research in hitherto unexplored domains under a fluid and internationally open system on a long-term and systematic basis.

The following research projects were implemented in FY86 and will be continued in FY89: 1) biological homeostasis research; 2) frontier material research; and 3) thought functions research (implemented in FY88).



Organization Chart of the System

### <Outline of Research System>

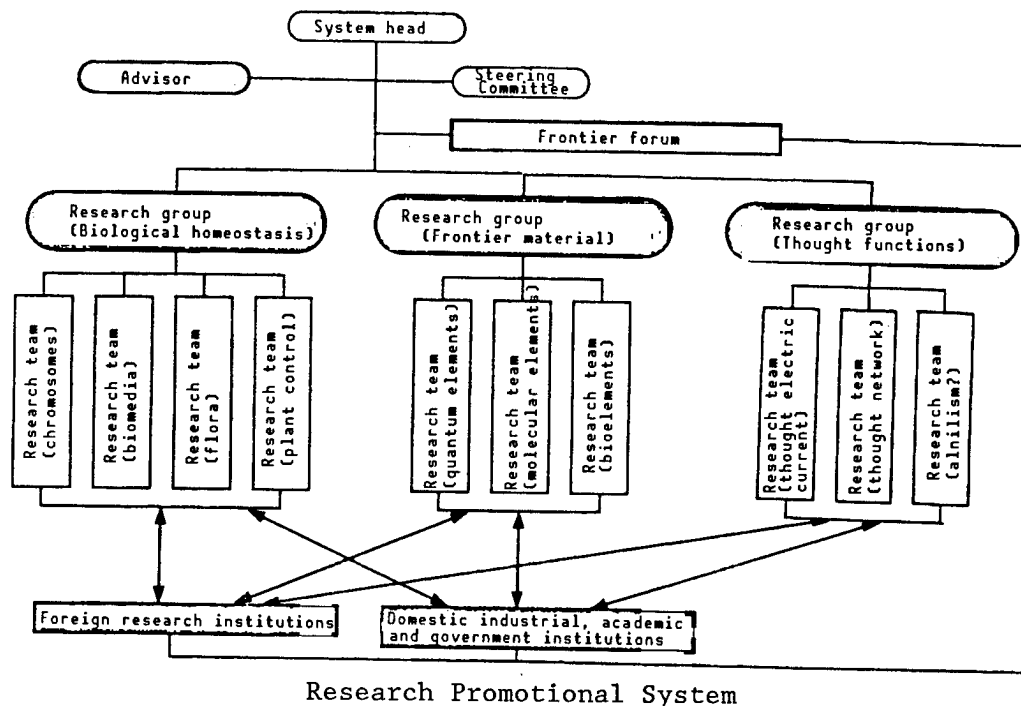
(1) **Steering organization:** Institute of Physical and Chemical Research

(2) **Basic operations:**

- Recruits a large number of researchers widely from industrial, academic, government and foreign institutions, and promotes research.
- Invites foreign researchers not only as researchers, but also as team leaders, under an internationally open system.
- Adopts a system to recruit the best qualified researchers in accordance with research progress, and implements long-term research through continuous research as a group.
- In principle, promotes research by securing the most advanced research facilities for research and experiment.
- Conducts forums to elicit creative ideas in a free and frank atmosphere, and promotes research through an exchange of views among domestic and foreign researchers.

(3) **Research scale:**

The above three research areas will be conducted by 10 research teams (each consisting of about 6 persons) on a long-term basis. Each period will last 5 years, with a total of three periods lasting about 15 years.



## II. UPGRADES THE R&D BASE

### 1. Promotes Large-Scale SOR Construction Program

#### (1) What Is a Large-Scale SOR?

Synchrotron orbital radiation [SOR] is a powerful light (electromagnetic wave) that appears in a tangent direction to the orbit when electrons, accelerated close to light velocity by extremely high energy, are bent by the magnetic field of an electromagnet.

This light is extremely bright and powerful (highly luminant). It is sharp and expands very little (has good directionality). It is a continuous light that extends from infrared and visible zones to the X-ray zone.

Consequently, it is expected to be useful in broad applications from the most advanced basic research to high-tech industries, including supermicro- and microanalysis, short-time measurement, supermicroprocessor, matter and material-related S&T, life sciences, and information and electronics-related S&T.

#### (2) S&T Agency's Position

The large-scale SOR facility of the 8 GeVc class that emits radiation of superior quality constitutes the base for promotion of a broad range of basic research, and it is expected to be useful in the exchange of industrial, academic, government and international research.

Plans are being pushed to establish large-scale SOR facilities in Europe and America also, and it is necessary for Japan to upgrade its main facilities and promote basic research that will enable it to contribute internationally.

Therefore, the S&T Agency is promoting R&D concerning large-scale SOR facilities in concert with the Institute of Physical and Chemical Research and the Japan Nuclear Research Institute as the core, while working for cooperation and exchange among related researchers.

## **2. Promotes Regional S&T**

In recent years, there has been growing enthusiasm in the regional areas for the promotion of S&T. The promotion of S&T is important for Japan as a whole in its efforts to upgrade its S&T standards with efficiency.

The fourth national integrated development program decided by the Cabinet in June 1987 is targeted to advance S&T by making the most of regional traits through cooperation from industrial, academic and government circles, in addition to promoting linkage between R&D functions in the various regions.

### **(1) Regional Research Exchange Promotional Project**

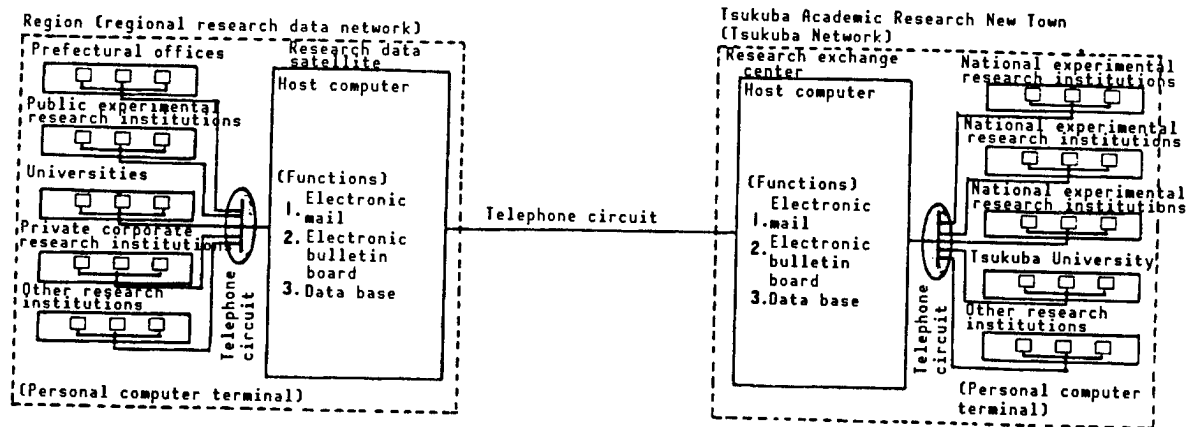
From FY88, a project to promote regional research exchange (regional high-tech network project) has been implemented for improvement of S&T standards in the regions. The project purports to build a regional research data network, and to promote development of talent exchange, informational exchange and technologies with the network as the core.

### **(2) Ocean S&T-Related Regional Joint R&D Project**

Beginning in FY88, a regional joint R&D project is being implemented to conduct R&D at the Ocean Science and Technology Center, in cooperation with local communities, on necessary technological themes to realize a concept for ocean use by the various local communities, in order to make comprehensive use of Japan's coastal areas.

### **(3) Regional S&T Promotional Council**

In order to foster opportunities for cooperation between S&T-related institutions and other sectors of society, and to contribute to the establishment of a base for regional S&T promotion, the nation will be divided into eight regional blocs. Understanding between the national government and the regions will be fostered, and reviews will be conducted on various problems concerning regional S&T promotion.



Regional High-Tech Network Project

### 3. Promotes Industrial, Academic and Government Research Exchange

#### (1) Research Exchange

In recent years, many S&T areas have straddled across several disciplines, as exemplified by biotechnology and mecatronics. In order to effectively utilize limited research resources, it is essential to aggressively promote research exchange between different systems and organizations in the form of joint research projects, researcher exchange and research data exchange, without adhering to established research organizations and systems.

#### ● Research Exchange at the S&T Agency

##### a. Promotion of joint research projects

- Promotional system for creative S&T (see p 6)
- International frontier research system (see p 7)
- Comprehensive research based on S&T coordination funds for promotion (see p 14)

##### b. Researcher exchange

- Visiting research officer system--Invite outside researchers as emergency duty employees
- In-country (Japan) study system--Send researchers of national experimental research institutions to national universities for study.

##### c. Others

- Exchange of research findings and data
  - Tsukuba network system (see p 9)
  - JOIS system (see p 12)
- Exchange through use of national experiment research facilities

In other government agencies also, research exchanges are pursued as follows. for example, regarding <Item a>--large-scale technology R&D (Ministry of International Trade and Industry), regarding <Item b>--a roving researcher system (Ministry of Agriculture, Forestry and Fishery), and regarding <Item c>--distribution of research data through annual reports published by various research institutions (all government agencies).

## **(2) On the Research Exchange Promotional Law**

The Research Exchange Promotional Law was established (enacted 19 November 1986) with the aim of widening the legal bottleneck to national research institutes regarding promotion of research exchange.

### **o Outline of the Research Exchange Promotional Law (Content of Special Measures**

#### **a. Exceptions to the National Employee System**

- Foreign researchers may be appointed as research public employees
- Expand opportunities for participation by research public employees in research meetings
- Periods of leave taken by research public employees to engage in research in the private sector may not be treated disadvantageously in calculating severance pay

#### **b. Exceptions to the National Assets System**

- A portion of patent rights and rights on new ideas for practical use, resulting from research consigned to national institutes by the private sector, may be transferred to the private sector as the consignor
- Patent rights and rights on new ideas for practical use, resulting from joint international research, may be used by the nations concerned, free or at low cost, on the basis of reciprocity.
- In joint international research, the right to demand compensation for injury may be relinquished vis-a-vis the nations concerned on the basis of reciprocity
- National experimental research facilities may be used by the private sector at low cost

Also, regarding operational bottlenecks, the government is maintaining unified and close interagency liaison for improvement via the Research Exchange Promotional Liaison Council (sponsored by the S&T Agency, et al.), based on the "basic policy concerning implementation of various systems pertaining to promotion of research exchange among industrial, academic and government and foreign institutions" (decided by the Cabinet on 31 March 1987).

## **(3) New Technology Development and Technology Transfer**

Practical application of the results of S&T experimental research is indispensable for upgrading of the national life. Since its establishment in



1961, the Research Development Corporation of Japan [RDCJ] has promoted commercialization of the results of experimental research through consigned development, and through mediation for development as the core institution for new technological development and technology transfer in Japan.

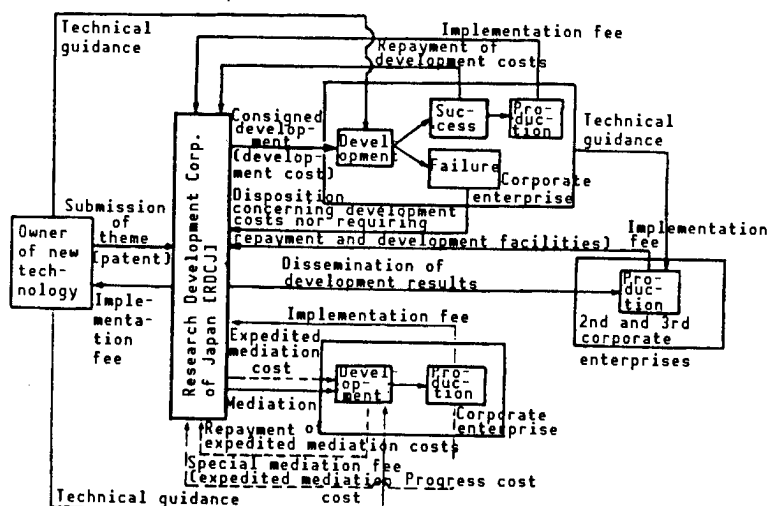
a. Consignment Developments & Dissemination of Results

In order to encourage practical application of the results of outstanding research by national university institutes, the RDCJ promotes commercialization of new technologies by accepting implementing rights for research results through consigned development to corporate enterprises, and by assuming development risks by defraying necessary development costs. It takes up consigned development themes that are important for the national economy, including such advanced technology as life sciences, new materials and electronics, in addition to energy-related technology; as well as technology related to improvement of the national life such as public pollution prevention and welfare. It also disseminates development results to corporate enterprises other than corporate consignees.

b. Mediation for Development

Broad mediation activity is conducted regarding research results that have not been industrially applied despite their small risk and adequate commercial value. Toward that end, surveys are also conducted to aggressively discover and publicize technological needs befitting regional corporate enterprises.

In addition, close cooperation with similar foreign development institutions and transfer of new domestic technology overseas are promoted.



Structure of New Technology Development Project

### **c. Projects for Evolvment of Advanced Research Results**

In order to foster new technology around results emanating from promotional projects for innovative S&T, and from national and university institutes, the RDCJ formed an evolving experiment promotional group (high-tech consortium) in FY86, in which multiple corporate enterprises and researchers in different fields participate. They conduct evolving experiments and projects to produce advanced research results for the purpose of establishing patents that will serve as the nucleus for evolvment of new technology.

#### **(4) Tsukuba Academic Research New Town**

The Tsukuba Academic Research New Town was built as a conglomerate of national experimental research institutes, universities and private research institutes. It thus constitutes a central base for research and academic learning in Japan. As of April 1989, there were about 150 research organizations in the Tsukuba New Town.

Those affiliated with the S&T Agency and conducting research activity affairs include: the National Research Institute for Metals, the National Research Center for Disaster Prevention, the National Institute for Research in Inorganic Materials, the National Space Development Agency's [NASDA] Tsukuba Space Center, the Institute of Physical and Chemical Research's Life Sciences Tsukuba Research Center, the Tsukuba branch of the Japan Information Center for Science and Technology/the Information and Data Building's Tsukuba Data Center, and the Research Exchange Center.

##### **a. Activities at the Research Exchange Center**

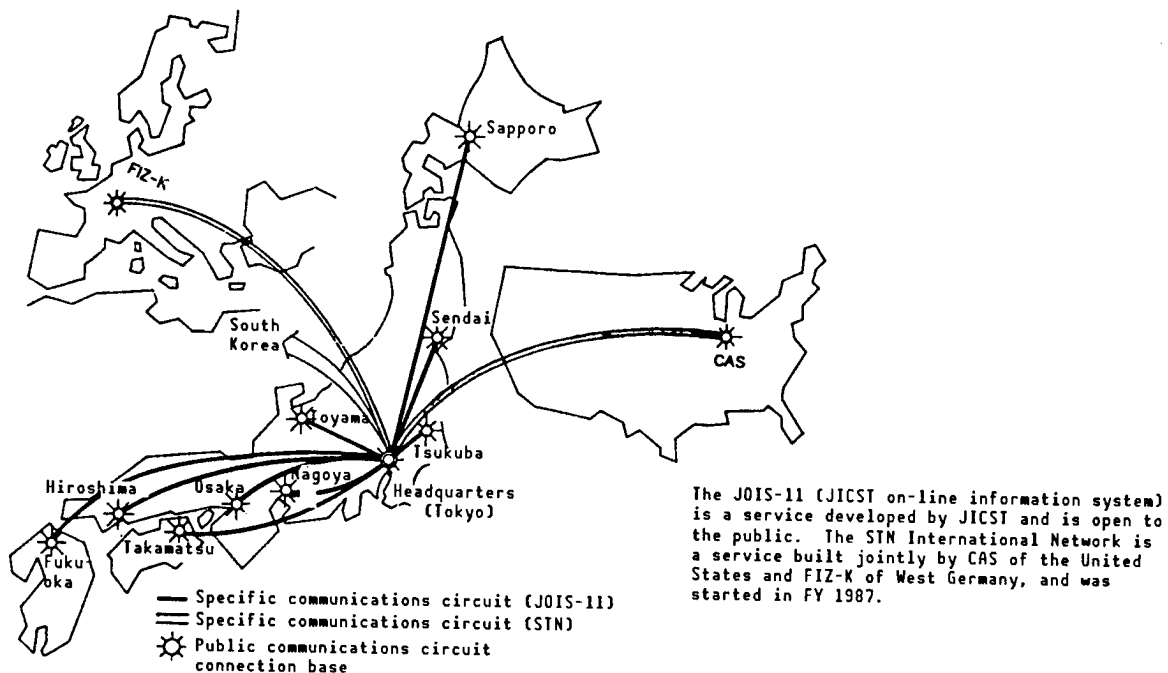
The center is a facility for joint use in Tsukuba New Town. It provides a forum for mutual exchange between researchers. It sponsors various lecture meetings and international symposiums. It manages housing facilities for foreign researchers; conducts language-training courses in Japanese, English and French; operates the Tsukuba research information network; and promotes research exchanges with various communities.

##### **b. Liaison Council for Research Organizations in Tsukuba New Town**

The liaison council (the secretariat is located in the Research Exchange Center) facilitates research exchange among government and private research organizations in Tsukuba New Town, and reviews their common problems.

##### **c. Others**

Efforts are made to upgrade function facilities and equipment, and to improve the treatment of researchers.



JICST's On-Line Information Service Network

#### 4. Promotes S&T Information Distribution

S&T information constitutes a vital national resource as concentrated results of R&D.

In order to promote distribution of annually increasing S&T data, the S&T Agency promotes the following policies and projects based on the "National Information Distribution System on S&T [NIST]" concept advocated by the Council for S&T.

##### (1) Promotes the NIST Concept

- a. Expansion of the domestic production data base
- b. Buildup of a general on-line network concerning S&T information
- c. Buildup of an integrated information system on (chemical) compounds
- d. Standardization of S&T information
- e. Promotion of international cooperative activities
- f. Surveys concerning S&T information

##### (2) Promotes Japan Information Center of S&T Projects

The following projects are implemented by the Japan Information Center for Science and Technology [JICST], which will serve as the nerve center for the NIST concept.

- a. Form a JICST data base (Data base documented data concerning S&T, factual information and research data; also data base domestic documents in English)

- b. Develop a data base information support and management system
- c. An on-line information search service
- d. Upgrade primary information services and guidance services
- e. Develop data processing technology
- f. Promote an international S&T information network
- g. Build a practical mechanical translation system
- h. Promote regional information services
- i. Promote international cooperation (e.g., cooperate with ASCA on S&T information).

#### IV. UPGRADES GENERAL PROMOTIONAL FUNCTIONS OF S&T ADMINISTRATION

In many nations throughout the world today, R&D is being intensified from the standpoint of vitalizing the economic society and enhancing the national welfare. Particularly in Japan, which is poor in resources, it is considered vital to stimulate human creativity and work aggressively for S&T advancement in order to achieve stable economic growth in the 21st century.

In particular, basic research cultivates the basic soil that nurtures next-generation technology, and it is important to intensify it.

Also, for Japan, which has become an economic power, its role to be played in the international society has expanded, and it is becoming correspondingly important for it to contribute internationally to S&T also.

Under these circumstances, in March 1986, the government decided (by Cabinet decree) on an "S&T policy outline" as the key to Japan's S&T policy, based on the long-term and comprehensive basic policy drafted by the Council for S&T, the highest deliberative organ on S&T policy.

With the outline as the base, the government is working to evolve a comprehensive and mobile S&T policy.

##### 1. Upgrades Planning and Coordinating Functions of S&T Administration

The importance of promoting comprehensive and effective R&D of the nation as a whole has further increased in recent years, and the upgrading of the planning and coordinating functions of S&T administration has therefore become indispensable.

In view of these circumstances, efforts have been made to build and strengthen the Council for S&T. A policy committee was formed within the council in March 1983 to promote reviews and deliberation, while coordinating funds for S&T advancement to be used in accordance with council policy have also been increased annually for better overall coordination.

In addition, the internal bureaus of the S&T Agency were reorganized in July 1986 as a link in the buildup of the council secretariat's operations. Furthermore, the S&T Policy Research Institute was established in July 1988 to upgrade S&T policy research as a base for policy evolvement.

## Main Contents of the S&T Policy Outline

---

### I. Basic Policy

1. Promote richly creative S&T as the core for the buildup of basic research
2. Evolve S&T with emphasis on internationality
3. Maintain harmony between S&T and the human society

### II. Promote Key Measures

1. Bolster the promotional system
2. Upgrade promotional conditions
  - (1) Expand R&D investment
  - (2) Train and secure talent
  - (3) Strengthen the S&T advancement base
  - (4) Expand international exchange cooperation

### III. Promote Key R&D Areas

1. Promote basic and leading S&T
    - (1) Matter and material-related S&T
    - (2) Information and electronics-related S&T
    - (3) Life sciences
    - (4) Software-related S&T
    - (5) Space S&T
    - (6) Ocean S&T
    - (7) Earth S&T
  2. Promote S&T to vitalize the economy
    - (1) Develop and manage natural resources
    - (2) Develop and utilize energy
    - (3) Upgrade production technology and the distribution system
    - (4) Recycle and utilize resources
    - (5) Improve social and livelihood services
  3. Promote S&T for qualitative improvement of society and the national life
    - (1) Sustain and improve the human spirit and physical health
    - (2) Form an individualistic and cultural life
    - (3) Form a comfortable and secure society
    - (4) Improve the human environment from the earth viewpoint
-

## 2. Spending for S&T Advancement and Coordination

As a link in further boosting the planning and coordinating functions of S&T administration, centering on the Council for S&T, overall promotion and coordination of important research affairs necessary for S&T advancement are implemented with S&T promotional and coordination funds in accordance with the council's policy.

### (1) Outline of Basic Policy on Utilization

- a. Promote advanced and basic research
- b. Promote R&D requiring cooperation from a plurality of institutions
- c. Strengthen organic unity among industrial, academic and government institutions
- d. Promote joint international research
- e. Respond flexibly whenever needs for emergency research arise
- f. Conduct research evaluation and R&D investigation and analysis

### (2) Thinking in FY88

Centering on the promotion of basic and lead S&T areas, emphasize matter and material-related S&T and life sciences. Also, consider the area of earth S&T. Regarding other areas, proceed on a priority basis, with an eye on response to R&D with strong social needs.

Also, given the importance of contribution to S&T commensurate with Japan's rising role in the international society, give consideration to aggressive promotion of international joint research, including the acceptance of foreign researchers. Furthermore, promote basic research targeted toward the creation of innovative technological needs, emphasizing creativity by researchers in the national experimental research institutes. Review promotional measures for R&D, and upgrade investigation and analysis for the establishment of research themes and tasks.

### (3) Status of Implementation in FY88

In FY88, the following items were promoted, based on the "concrete application of FY88 S&T advancement and coordination spending" (14 April 1988) decided by the policy committee of the Council for S&T.

#### a. Promote Basic and Leading S&T Areas

Based on recent research trends, emphasis is placed on the two areas of matter/material-related S&T and life sciences with which Japan must grapple urgently, and it must promote 19 research themes including "research on the development of technology for the creation, measurement and use of a super-vacuum."

**b. Promotes R&D for Strong National and Social Needs**

Promotes four research themes such as "research on upgrading of snow accumulation countermeasure technology."

**c. Promotes Aggressive International Response**

Promotes five research themes such as "research on elucidation of the (lift-related) ocean plate-forming zone in the South Pacific," and individual and key international joint research to boost international research exchange.

Also, beginning in FY88, promotes new international fluid basic research, with basic and leading research in national experimental research institutes conducted by researchers, including foreign researchers.

**d. Promotes Investigation and Analysis**

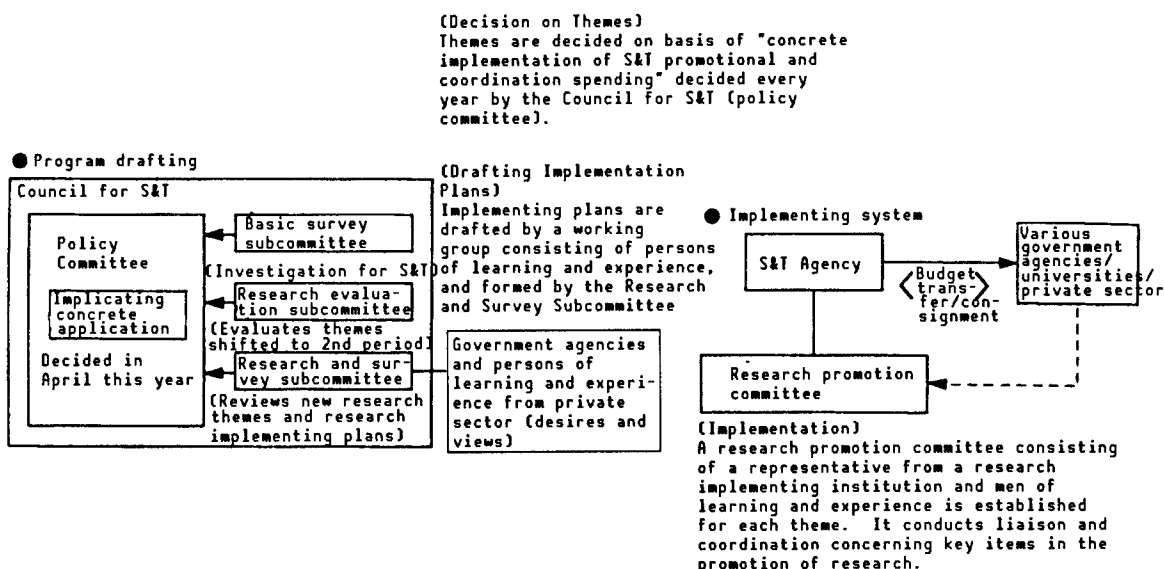
Promotes investigation for the drafting of S&T policy, and promotes eight investigation themes for the establishment of research themes.

**e. Promotes Key Basic Research at National Experimental Research Institutes**

Promotes basic research to create innovative technological needs, emphasizing creativity by researchers at national experimental research institutes.

**f. Promotes Emergency Research and Mobile International Response**

Promotes four themes such as "emergency research on primary screening to develop foreign substitutes," and emergency consigned research occurring during the course of a fiscal year.



Implementing System for S&T Promotion and Coordination

### 3. Promotes S&T Information and Education

#### (1) S&T Information and Education

The following information and education projects are conducted to obtain broad understanding and cooperation among the general population concerning S&T policies:

- a. Enforces and promotes "S&T Week" and "Nuclear Energy Day"
- b. Plans and broadcasts radio/TV programs
- c. Produces S&T movies with free loans by audio/visual libraries
- d. Publishes and distributes copies of "The Status of the S&T Agency"
- e. Sponsors S&T seminars
- f. Enforces nuclear energy monitoring
- g. Recommends S&T movies

#### S&T Television and Movies (FY88)

##### S&T Television

Program title	Station
"More Knowledge About the Earth" --Frontline of Earth S&T--	Fuji-TV
"Friendly Japan, Friendly Science" --Foreign researchers portrayed--	Nippon-TV

##### S&T Movies

Movie title	Length	Specifications
"About Radiation Rays" --Our life and radiation--	25 minutes	16 mm film
"S&T Promotion in Japan" --Policy and structure--	20 minutes	1/2 inch videotape (VHS in English)

#### (2) Encourage Inventions

##### a. Announces noteworthy discoveries selectively

Among inventions and discoveries for which applications have been filed and announced during the past approximately 3 years, outstanding ones have been selected as "noteworthy achievements" and made public during "S&T Week."



**b. S&T-related awards**

**i) S&T Agency director awards**

The following have been awarded for S&T achievements:

- Researchers performing distinguished S&T results (superior S&T development and dissemination)
- Researchers performing distinguished research (superior S&T research)
- Researchers with original ingenuity (performed in the workshop)
- Schools contributing to originality in education (illustrious results of originality in elementary and intermediate education)
- Persons conducting outstanding S&T promotion (superior achievements)
- Individuals or organizations contributing to nuclear safety

**ii) Medals**

Based on recommendations by the related government agency or prefectural office, S&T research award candidates are selected for the Yellow, Purple or Indigo Ribbon Medals, and the recommendations are submitted to the prime minister for approval.

**iii) Decorations**

S&T-related candidates for decorations are selected by request of the affiliated organizations of the prefectural office, and submitted to the prime minister for approval.

**V. PROMOTES R&D IN ADVANCED AND IMPORTANT S&T FIELDS**

**1. Promotes Measures for Nuclear Development, Use and Safety**

For Japan, a nation depending on other nations for most of its energy resources, it is necessary to aggressively promote the use of R&D on nuclear power as the most promising and realistic substitute for oil. Consequently, it strives to expand its nuclear power generation, while further solidifying safety measures, and it seeks the understanding of its people. At the same time, it aggressively promotes R&D on the nuclear fuel cycle and new power reactors necessary for nuclear power as a stable energy source in the future.

The promotion of such R&D uses is based on a long-term nuclear energy development plan determined by the Japan AEC.

**(1) Expands and Strengthens Nuclear Safety Measures**

**a. Strengthens nuclear safety control administration**

The functions of the Japan AEC are bolstered, and safety checks conducted by the administrative agency are double-checked for assurance. Also, upgrading of Japan's safety check standards is sought by participating aggressively in international cooperation. Concurrently, efforts are made to upgrade safety

control administration, including strengthening of the inspection system and safety regulation concerning radioactive wastes.

**b. Promotes safety research**

**i) Engineering safety research**

Centering on the Japan Atomic Energy Research Institute, research is promoted concerning the safety of light water reactors, new types of power reactors --including high-speed breeder reactors, and such nuclear fuel cycle installations as recycling facilities.

**ii) Environmental radiation safety research**

The National Institute of Radiological Sciences is the center for promotion of research on the impact of low-level radiation, in addition to experiments with the use of plutonium in internal explosion-proof test chambers.

**iii) Radioactive waste safety research**

Centering on the Japan Atomic Energy Research Institute and other institutions, aggressive research is promoted concerning the safety of radioactive waste disposal.

**c. Strengthens disaster prevention measures**

With the aim of protecting the national health and safety during emergencies, efforts are made to bolster disaster prevention measures, including an emergency liaison network, an environmental radiation control system, the buildup of an emergency medical care system and promotion of related research.

**d. Strengthens radiation damage prevention measures**

To cope with the dissemination and expansion of radiation use, efforts are made to strengthen the safety control system for radioactive isotopes.

**e. Secures environmental safety**

Continuous all-out measures are taken for the surveillance of environmental radiation, including the environs of nuclear power facilities, and for investigation of radioactive fallout from nuclear tests.

**f. Strengthens worker safety measures at nuclear power facilities**

Safety measures are promoted, such as unified registration and volume control of radiation exposure by workers at nuclear power facilities.

## **(2) Establishes Nuclear Fuel Cycle**

Establishment of a nuclear fuel cycle, including the securing of natural uranium, uranium enrichment, reprocessing, and the processing and disposal of radioactive wastes, is indispensable in order to promote nuclear-power generation in Japan, and to stabilize a long-term energy supply.

### **a. Secures uranium resources**

Japan, which lacks uranium resources, must depend on foreign uranium, and the Power Reactor and Nuclear Fuel Development Corp. is surveying ore resources in Canada, Australia, the African countries and China.

### **b. Develops uranium enrichment technology**

Operation of a prototype plant in Nigyo-toge, Okayama Prefecture, will continue, and construction will begin on a practical-scale cascade test facility, using a new-element high-performance centrifuge.

Also, a commercial plant program centered on private projects will be promoted.

Furthermore, development of a laser method is being promoted as next-generation uranium enrichment technology.

### **c. Reprocessing**

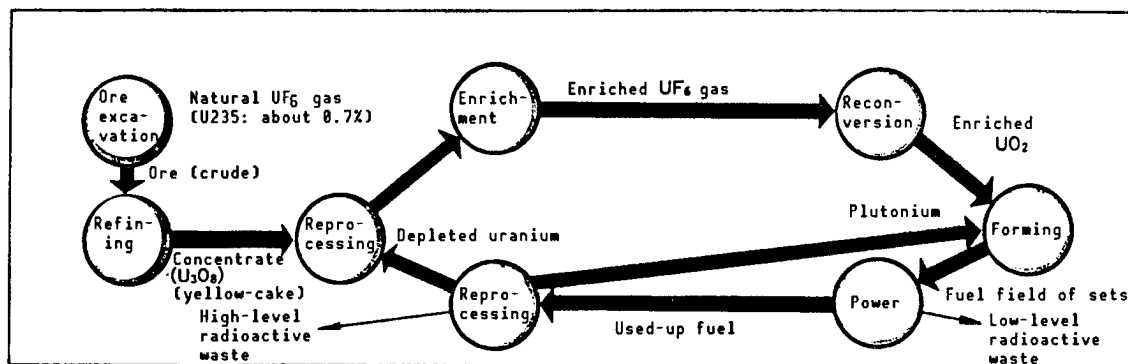
Efforts to stabilize operations at the Tokai reprocessing plant of the Power Reactor and Nuclear Fuel Development Corp. goes on while promoting technological development. Also, necessary support is provided for the construction of private reprocessing plants.

### **d. Processes and disposes radioactive wastes**

i) Regarding ground disposal of low-level radioactive wastes, support is given for construction of facilities centering on private projects, and experimental research concerning safety is also promoted. Regarding sea disposal, a cautious posture is taken to avoid any disposal that ignores the concerns of other nations. In addition, necessary development attending the problem of facility abolition is promoted.

ii) Regarding high-level radioactive wastes, the Power Reactor and Nuclear Fuel Development Corp. serves as the center in promoting construction of a glass solidification facility and R&D on ground stratum disposal. A plan for a "storage engineering center" is also pushed to conduct deep stratum tests and the storage and control of glass solids.

Also, R&D on nuclide separation-and-annihilation processing is conducted.



Nuclear Fuel Cycle Chart

### (3) Develops New Power Reactors

Centering on the Power Reactor and Nuclear Fuel Development Corp., development is pushed for new types of power reactors (new converter reactor and high-speed breeder reactor) that can use uranium resources more effectively than the light water reactor now in principal use at nuclear power generation plants.

#### a. High-speed breeder reactor

The test reactor "Joyo" (heat output: 100,000 kw) is in operation. Meanwhile, construction of the prototype reactor "Monju" (electricity output: 280,000 kw) proceeds with FY92 as the critical target date.

#### b. New converter reactor

With the prototype reactor "Fugen" (electricity output: 165,000 kw) in operation, related research is conducted on a demonstration reactor, and a demonstration reactor program is promoted.

### (4) Promotes Lead Projects

#### a. Nuclear fusion

The Japan AEC is the center for promotion of R&D on nuclear fusion--the future energy source for mankind.

In September 1987, the Japan AEC's critical plasma testing facility (JT-60) reached the target domain for critical plasma conditions.

#### b. High-temperature engineering

Construction plans are underway for a high-temperature engineering experiment research institute. It will serve as a research facility to establish and upgrade a base for high-temperature gas-reactor technology with such superior traits as: high-temperature supply, high and unique safety, and high combustibility, in addition to conducting advanced basic research concerning high-temperature engineering.

c. Nuclear ship

R&D is conducted by the nuclear ship "Mutsu" to obtain basic data and knowledge necessary for future R&D on ship reactors.

(5) Facilitates Location of Nuclear Power Facilities Including Power Generating Stations

In order to facilitate locating nuclear power facilities, efforts are made to build public facilities necessary for the improvement of welfare for residents near nuclear power facilities, based on the three power generation laws, and to strengthen safety measures. Concurrently, propagation, education and information activities are conducted to win the people's understanding and cooperation regarding nuclear power use.

Also, in FY88, various measures were taken to facilitate the use of "subsidies for the location of power stations" under the special account for promotional measures concerning the development of power resources.

(6) Enhances International Response

The policy regarding international cooperation in nuclear energy is to fulfill Japan's international responsibility as an advanced nation in peaceful uses of nuclear energy, based on the principal direction of the basic law on nuclear energy to "assume the initiative in contributing to international cooperation." The policy also involves contributing internationally as an engine in promoting nuclear energy development and use with the three basic goals of pursuing the world's common benefits, efficient use of R&D resources and upgrading the international environment for promotion of peaceful uses of nuclear energy, seeking to render them compatible with nuclear nonproliferation. Simultaneously, the aim is to promote the goals subjectively and aggressively, recognizing the importance of securing nuclear safety.

a. Regarding the advanced nations, it is considered vital to cooperate harmoniously with them from the standpoint of pursuing the world's common interests. Also, international cooperation will be evolved aggressively and independently concerning areas and elemental technology in which Japan has achieved certain technological standards.

b. Regarding the developing nations, improvement of the research base will be stressed, taking into construction the circumstances of the particular nation in question. From the early stage of that nation's nuclear development and use program, Japan will promote cooperation in accordance with its level of nuclear development and facilitate that development.

In particular, the Asian region, which has close geographic and economic relations with Japan, has numerous common tasks in the field of nuclear energy. Therefore, in order to use R&D resources efficiently, and because cooperation is useful for the entire region including Japan, regional cooperation will be promoted aggressively based on regional agreement.

c. Regarding such international organizations as the IAEA [International Atomic Energy Agency], the OECD and the Nuclear Energy Agency [NEA], aggressive contribution will be offered in order to fully manifest their respective traits.

d. In order to secure peaceful uses of nuclear energy and to implement steps to guarantee security (nuclear matter control system to confirm that nuclear matter for peaceful use is not converted to use for military purposes), based on such international promises as the nuclear arms nonproliferation treaty, domestic guarantee measures are implemented and efforts made to strengthen and upgrade them.

Also, broad efforts are made to perfect the nuclear matter protection system necessary to prevent such acts as pilferage of nuclear fuel matter from atomic energy facilities.

e. Furthermore, in order to facilitate Japan's international response, efforts are made to build an appropriate domestic environment.

## **2. Promotes Space Development and Use**

### **(1) Basic Direction of Space Development**

Space is a new sphere of activity for mankind, and the promotion of its development and use is attracting attention from all quarters as producing a new advanced-technology industry.

Japan's space development is being implemented comprehensively and systematically under the Space Activities Commission in accordance with a long-term "space development policy outline" and the "space development program" that is reviewed and planned each fiscal year in response to a variety of circumstances.

The space development policy outline was drafted in March 1978 and revised in February 1984. However, beginning in December 1987, the outline has been reexamined in response to a change in the situation, including full-fledged international space development and use.

### **(2) Space Development System**

Japan's space development is implemented largely in two categories: practical use and space science observation.

Space development in the practical use category is promoted by the National Space Development Agency [NASDA]. To date, a total of 22 manmade satellites have been launched with the N-I, N-II and H-I rockets. On the other hand, in the space science category, a total of 18 scientific satellites have been launched to date by the Ministry of Education's Institute of Space and Astronautical Science.

Other leading basic research is conducted at the S&T Agency's National Aerospace Laboratory and institutes of related government agencies.

### (3) Status of Space Development

Solid achievements in Japan's space development were seen during FY88, including the communications satellite 3-b "Sakura 3-b" successfully launched by the H-I rocket in September.

Future R&D on communications, broadcast and weather observation satellites and rockets is planned with the purpose of realizing a richer life for the nation, and to fulfill Japan's responsibilities in global space activities.

### (4) Development Program for Artificial Satellites and Rockets

The development program of the National Space Development Agency is as follows:

#### a. Artificial Satellite Development Program

Artificial satellite	Launch date	Launch rocket
Stationary weather satellite 4 (GMS-4)	Summer FY89	H-I
Ocean observation satellite 1-b (MOS-1b)	Winter FY89	H-I
Broadcast satellite 3-a (BS-3a)	Summer FY90	H-I
Broadcast satellite 3-b (BS-3b)	Summer FY91	H-I
Earth resources satellite 1 (ERS-1)	Winter FY91	H-I
Technical test satellite VI (ETS-VI)	Summer FY92	H-II
Stationary weather satellite 5 (GMS-5)	Winter FY93	H-II
Earth observation platform technical satellite (ADEOS)	Around FY93 (under R&D)	H-II

#### **b. Rocket Development Program**

In order to meet the demand for artificial satellite launches after 1986, stationary weather satellites, ocean observation satellites and broadcast satellites have been launched, using the H-I rocket with its thrust improved by the use of liquid-oxygen and liquid-hydrogen engines.

Also, in order to meet the demand for the launch of large artificial satellites during the 1990s, development is pushed with the goal of launching the first test H-II rocket in FY91 with a capacity to launch a two-ton stationary satellite. This will be accomplished by using liquid-oxygen and liquid-hydrogen engines for the first and second stages, and adding two auxiliary rockets.

#### **c. First Material Test Program (FMPT)**

A test system is being developed for implementation FY91 when a Japanese scientist will ride on a space shuttle to conduct material tests, utilizing the conditions of space. Also, various training exercises are conducted for the benefit of the scientist-astronaut.

#### **d. Space Station Progress**

A test module is being developed as a link in the participation in the space station program with international cooperation by Japan, the United States, Europe and Canada. In September 1988, 12 participating nations signed a space station cooperation agreement determining the framework of cooperation following a detailed design of the program. The start of the space station launch is slated for 1994, and the start of full-fledged operations for 1998.

### **5. International Cooperation**

#### **a. Cooperation with the United States**

The Japan-U.S. Standing Staff Liaison Council [SSLG] has been meeting since 1979 to promote cooperation on space projects between Japan and the United States, and to review new cooperative projects.

#### **b. Cooperation with Europe**

Since 1972, periodic conferences have been held, and exchanges of data and scientists have been conducted with the European Space Agency [ESA].

#### **c. International Space Year [ISY]**

The year 1992 has been designated as International Space Year. Active studies are being made concerning implementation of educational and propaganda activities on space development through international cooperation in earth observation, principally by the United States, Europe and the Soviet Union, and Japan is also considering participation.



#### d. Others

International cooperation in various forms is being implemented, such as membership in the United Nations commission on peaceful uses of space, and direct reception of data from the ocean observation satellite "Momo-1" by ESA, Australia, Canada and Thailand.

### 3. Promotes Ocean Development

The oceans, which cover about 70 percent of the earth surface, contain abundant mineral, life and energy resources. They also encompass broad areas of space, and their development and use are expected to play an extremely large role in the future of mankind.

Also, in April 1982, the United Nations' ocean law agreement was adopted. The world is about to enter a 200 sea-mile (territorial) age, and contribution to the international society is demanded of Japan as a maritime nation.

Furthermore, attention has recently begun to be focused on earth S&T for the purpose of comprehensive understanding of the seas, and marine S&T is playing a significant role in its promotion.

#### (1) Comprehensive Government Promotion of Marine S&T

In Japan, the Oceanographic Development Council, an advisory organ under the prime minister, is promoting ocean development, respecting the reports submitted in 1979 and 1980 concerning "the basic concept and promotional measures concerning ocean development from a long-term outlook." Also, in February 1989, new questions concerning the 21st century were submitted to the council.

The S&T Agency oversees the affairs of the Oceanographic Development Council. In addition, in order to maintain close liaison among agencies involved in ocean development and marine S&T development, the liaison council of related agencies on ocean development meets to draft an "ocean development promotional program" that summarizes the government's policy on ocean development for every fiscal year.

#### (2) Promotes Projects at the Center for Marine S&T

With the Center for Marine S&T as the core, the S&T Agency promotes R&D on leading and basic oceanographic S&T.

The projects promoted by the center are as follows:

##### a. R&D on deep-sea diving survey ships

The deep-sea diving survey ship "Shinkai 2000," its mother ship "Natsushima" and the unmanned probe ship "Dolphin 3K" are used to conduct R&D on deep-sea survey technology.

Also, in order to contribute to forecast research concerning deep-sea mineral resources and earthquakes, the deep-sea diving survey ship "Shinkai 6500" and its mother ship "Yokosuka" are under construction.

<Outline of the "Shinkai 6500">

Maximum diving depth: 6,500 meters

Total length x width x height: about 9.5 meters x 2.7 meters x 3.2 meters

Weight: about 25 tons

Underwater speed: maximum 2.5 knots

Number of crew: 3

b. R&D on diving technology

In order to promote development of the continental shelf, and operation and control of ocean structures, R&D is conducted on diving technology with a depth of 300 meters as the goal. The diving test ship "Kaiyo" is used to implement actual ocean experiments under the "New Seatopia Program."

c. R&D on ocean observation technology

In order to understand and explain broad and three-dimensional ocean upheaval phenomena speedily and efficiently, various R&D on ocean observation technology is conducted through advanced technology.

In addition, the Center for Marine S&T conducts R&D on ocean-use technology, provides large experiment research facilities, and collects and provides data material.

(3) Promotes Other Projects

The S&T Agency provides the use of the Center for Marine S&T in addition to the above, and implements the following projects with the cooperation of the related agencies.

a. Investigation and research on development and use of the "Kuroshio" current

In order to effectively use the "Kuroshio" current, which has a vital impact on Japan's weather, ocean conditions and marine industry, investigative research is promoted under cooperation with related government agencies concerning the Kuroshio's change structure, purification function, basic structure for sea-life production, energy and the interaction between the atmosphere and the ocean. One of the initial results of Japan's research was the successful prediction, for the first time ever, of the Kuroshio's large meandering course. Since FY86, Japan has been conducting joint surveys and research with China.

**b. Promotes technological development on overall use of the ocean areas (Aquamarine Program)**

Investigation and reviews are conducted concerning marine S&T themes necessary for the realization of concepts for ocean-area uses conceived by communities in Japan. R&D is implemented on key overall themes.

In particular, beginning in FY88, regional joint R&D projects are implemented at the Center for Marine S&T.

**(4) Promotes Marine S&T Development With S&T Promotional and Coordination Funds**

Furthermore, based on S&T promotional spending, the following marine S&T development projects are implemented:

a. Research on the elucidation of the (lift-related) ocean plate-forming region in the South Pacific

b. Research concerning development of technology for the effective use of deep-sea resources

**(5) Promotes International Cooperation**

In addition to multilateral cooperation, such as cooperation with the Pacific nations, bilateral committees have been formed with the United States, France and West Germany to conduct information exchange, researcher exchange and joint research.

**4. Promotes R&D on Earth S&T**

Earth S&T is extremely important in order to grapple with such global phenomena as abnormal weather, transformation into deserts, the warming of the earth and huge earthquakes that threaten mankind's existence. By conducting comprehensive surveys and research concerning the atmosphere, water areas, land areas and life that form such phenomena, as well as their interaction, efforts are made to elucidate their organization, and to solve the problems.

The S&T Agency is promoting comprehensive research to explain the various phenomena, the R&D on earth observation technology and the R&D on disaster prevention S&T.

**(1) Research on Elucidation of Global Phenomena**

In order to elucidate global phenomena, "research concerning the structure of Asian monsoons" and "research concerning the structure of the deep earth-crust" were started in FY89 with special investigation and research funds for earth S&T. Concurrently, "international joint research concerning atmospheric and ocean upheavals" in the Pacific Ocean is promoted with cooperation by

related government agencies and universities, using funds for S&T promotional and coordination funds.

## **(2) R&D on Earth Observation Technology**

Remote-sensing is a technology for the observation of objects and phenomena on the earth surface by measuring light and radiowaves, which are reflected or radiated on the earth surface from satellites and aircraft, and it is suitable for broad and continuous observation. In particular, remote-sensing by earth observation satellites makes long-term observation of the entire earth possible, and it is an extremely important observation means for earth S&T.

In FY89, the S&T Agency is promoting research in remote-sensing utilization technology, while the National Space Development Agency [NASDA] is promoting the following earth observation satellite projects.

a. With observation of ocean phenomena as the main purpose, the marine observation satellite 1-b (MOS-1b) will be launched to continue observations by the marine observation satellite 1 (MOS-1) launched in February 1987.

b. Development will be promoted concerning the earth resources satellite 1 (ERS-1), which is scheduled for launching in FY91, with the establishment of active observation as its main purpose.

c. Development and research will be promoted concerning the earth observation platform technical satellite (ADEOS), which is scheduled for launch around FY93, with the maintenance and advancement of earth observation technology as its purpose.

d. Studies will be made concerning participation in the polar orbit platform program, during which large earth observation satellite(s) will be launched with international cooperation in the latter half of the 1990s.

Also, in view of the importance of increasing knowledge concerning the oceans, which cover about 70 percent of the earth's surface, and in order to explain various phenomena, construction of the deep-sea diving survey ship "Shinkai 6500" and R&D on such ocean observation technology as ocean laser are promoted to survey and observe the structure of ocean upheavals.

## **(3) Promotes R&D on Disaster Prevention Technology**

Promotion of disaster prevention technology is extremely vital in protecting the people's lives and assets from earthquakes and snow disaster. Therefore, the S&T Agency is promoting R&D on disaster prevention through research at the National Research Center for Disaster Prevention, using S&T promotional and coordination funds provided by the "basic S&T program on disaster prevention" decided (on 22 July 1981) by the prime minister.

**a. Research on earthquake prediction**

With the Tokai region designated in August 1979 as a region for implementation of stronger protection measures against earthquake disasters on the basis of the "large-scale earthquake special measures act," the Earthquake Prediction Promotion Bureau (director, the S&T Agency director) is seeking unified cooperation from related government agencies and universities to build observation facilities for earthquake prediction, centering on the Tokai region. It is also working to upgrade observation and research.

**b. Other research at the National Research Center for Disaster Prevention**

**i) Special research on earthquake disaster countermeasures**

Research is conducted on earthquake-causing mechanisms and on prediction of huge sea-trough earthquakes, led by observation research through an observation network on high-density micro-earthquakes and dips in the Kanto and Tokai regions. It includes observation posts on deep-stratum earth-crust activity on the 3,000 meter level in the Tokyo capital area (three facilities in Iwatsuki, Shimofusa and Fuchu). Research is also conducted on forecast methods concerning ground-tremor damage.

**ii) Others**

As special research on snow disaster countermeasures, general research is conducted on the prevention of snow disasters in the regional societies, in addition to research on elucidation of ground snowdrift-causing mechanisms and the development of disaster-prevention technology. Also, special research is conducted on weather disaster-causing mechanisms and evaluation of their impact. Other research is conducted on the prediction of volcanic eruptions in the Iwojima and Izu-Oshima Islands, and experimental research on prevention of ground slide and coastal damage. Other concurrent activities include the collection, filing and dissemination of data on disaster-prevention S&T.

**5. Promotes R&D on Matter and Material-Related S&T**

Matter and material-related S&T provides a base for progress in other S&T areas, and is expected to perform a role as a driving force for future technological reforms.

Particularly in the advanced S&T areas, new materials that were hitherto undreamed of are demanded, such as superconductive materials, high heat-resistant materials, high-strength materials and electronic materials. In the future, the manufacture of matter and materials with revolutionary functions that use methods based on new ideas will be vital.

Toward that end, the S&T Agency, centering on the National Research Institute of Metals and the National Institute for Research in Inorganic Materials, will promote comprehensive R&D on a broad range of materials from basics to

application, using funds for S&T promotion and coordination, creative S&T promotional projects and the international frontier research system.

**(1) Promotes Superconductive Material Research Multicore Project**

In FY88, the "superconductive material research multicore project" was established, and key basic research on new superconductive materials is promoted under a flexible research system centered on researchers, which is open to industrial, academic and government and foreign institutions.

**(2) Research at the National Research Institute of Metals**

- R&D on superconductive materials for use in superconductive power transmission without any transmission loss, and for the linear motor car that is called the "dream superhigh-speed train"
- Development of a high performance semiconductor laser with a superthin multilayered structure that emits medium infrared-zone rays used for superlong-distance optical communications
- R&D on a noncontact evaluation method for materials, using laser that can be measured under high temperatures or extremely low temperatures
- Others are the creation of new materials, and the development of new technology to evaluate the reliability of materials.

**(3) Research at the National Institute for Research in Inorganic Materials**

- R&D on diamond semiconductors using high-integration and high-performance super LSIs
- R&D on apatite with superior strength and affinity with living organisms said to be required for artificial bones
- R&D on super abrasion-resistant materials for use in superhigh-speed and super-precision processing of ceramics
- Also, research on the creation of new inorganic materials

**(4) Implementation With Funds for S&T Promotion and Coordination**

"Research on key technology for the creation of new functions with high-purity rare metals" and "research on key technology to develop tilt-function materials for heat relaxation" are promoted.

**(5) Implementation Through Creative S&T Promotional Project**

Promotes a project with five themes, including "chemical organization," "supermicro-transformation" and "quantum waves."

**(6) Promotes an International Frontier Research System**

Research on frontier materials (quantization elements, molecular elements and bioelements) is promoted.

**6. Advancement of Life Sciences**

Life sciences use various areas of S&T of the highest order to explain life phenomena. The knowledge is also applied to improve health and medical care, to preserve the environment, to secure food resources and to develop new industrial technology. The S&T helps to improve the national welfare, such as conquering cancer, and supports the leaping progress of future S&T.

The S&T Agency promotes the following research:

**(1) Research by S&T Agency's Research Institutes**

**a. Institute of Physical and Chemical Research**

In addition to research on functions to maintain the homeostasis of organisms, and the promotion of analysis and research on human chromosome genes, the Life Sciences Tsukuba Research Center promotes leading and key research on human cancer genes, using rearranged DNA technology.

Also, support projects are implemented, such as a gene that is indispensable for promotion of life sciences.

**b. Other research institutions**

The Research Development Corporation of Japan promotes R&D under the creative S&T promotional system and consigned development system. The National Institute of Radiological Sciences promotes research on cancer treatment, using baryon rays. The Japan Information Center of S&T promotes data collection and distribution.

**(2) Promotes Research Projects Through Industrial, Academic and Government Cooperation**

Research in such advanced and key areas as "research concerning development of basic technology for elucidation of the immunity response mechanism" and "research concerning common and key technology supporting cancer research" are being promoted with the participation of national experimental research institutions, universities and private research institutes.

**(3) International cooperation in Life Sciences**

As examples of international cooperation in the life sciences, cooperation is promoted in information exchange and research exchange under the Japan-U.S. agreement on S&T research and development and the Japan-West Germany agreement on S&T cooperation.

## **7. Promotes R&D in Aeronautical Technology**

### **a. Promotes R&D of the fan-jet STOL**

The fan-jet STOL is a new type of aircraft suited to Japan's conditions, given its takeoff and landing capabilities at short distances and its low noise.

The S&T Agency plans to establish technology that will enable Japan to independently develop such aircraft with superior adaptability to the environment, and thus drastically upgrade Japan's aeronautical technology. It is therefore promoting R&D of the fan-jet STOL at its National Aerospace Laboratory, centering on development of an experimental plane and flight tests.

In FY89, with the purpose of arranging various data obtained through flight tests of the STOL experimental plane "Hicho" at a data base for broad and efficient use, it will conduct necessary ground tests, and also implement joint research with the U.S. National Aeronautical and Space Agency [NASA] on the STOL plane.

#### **<Development Progress and Planning>**

FY79: Start basic design

FY79-85: Manufacture fuselage and engine  
Complete plane assembly and testing

FY82-86: Prepare flight test-related facilities and equipment

FY83-84: Conduct in-flight engine tests

Oct 85: Conduct maiden flight and start in-company flight tests

FY86-88: Conduct flight tests

FY89-91: Build a data base

### **b. Promotes leading aeronautical research**

In addition, the National Aerospace Laboratory will promote research on elemental technology for revolutionary air and space transport, numerical simulation technology and application of aeronautical technology to other areas--all targeted toward the space brain expected to materialize in the 21st century for the purpose of upgrading aeronautical technology.

They constitute basic and leading research that is indispensable for Japan's aircraft development.

Also, as facilities necessary for R&D on aeronautical technology, remodeling of the transonic wind tunnel and a buildup of facilities for structural



testing of compound material will be implemented in FY89, continuing from the previous year.

## **8. Promote Other Vital General Research**

### **(1) Promotes Measures for Comprehensive Use of Resources**

In order to cope with Japan's resources problem, which grows further complicated with social and economic upheavals at home and abroad, it is urgently desirable to seek development and use of new resources, as well as a rational use of resources.

Therefore, the S&T Agency is pursuing the following measures.

#### **a. Investigation and deliberation by the Resources Council**

The Resources Council's role is to investigate and deliberate on comprehensive steps on the use of resources. It has been reviewing the problem of S&T advancement and resources since 1988, and the problem of earth environment changes and resources.

#### **b. Follow-up of the Resources Council's findings and promotion of research on comprehensive use of resources**

The S&T Agency promotes the reflection of reports and advice by the Resources Council on measures taken by related agencies. In addition, it promotes the following projects:

- Analytical research on inorganic materials implemented as a follow-up project of the "fourth revised table of standard Japanese food ingredients" made public in October 9182.
- Investigation and review of measures for the comprehensive use of resources based on future changes in the earth environment.

### **(2) Laser**

#### **a. What is laser?**

Laser is a dream artificial ray produced by modern physics. It has such superior properties as a single wavelength, high directionality and strong light-intensity. It is expected to bring radical progress in many fields, including optical data processing, optical communications, photochemistry, medical-care technology and nuclear fusion.

#### **b. Research at S&T Agency**

In order to cultivate an independent base for Japan's laser S&T, the Institute of Physical and Chemical Research places special emphasis on laser application in chemistry (laser-induced chemical research) as follows:

- i) Research on separation of laser double-element isotopes
- ii) Research on new laser technology
- iii) R&D on new planning methods
- iv) Research on critical-domain laser chemistry (started in FY88)

So far, it has succeeded in complete separation of tritium (fuel for nuclear fusion reactors) for the first time in the world.

It has also implemented "research on the creation and use of vacuum ultraviolet rays" with S&T development funds.

Furthermore, it is pursuing development of uranium enrichment technology with the use of laser in the nuclear energy field.

## VI. SCIENCE AND TECHNOLOGY AGENCY BUDGET

### FY89 S&T Budget

Unit: ¥1 million

\*National bond debt (applies to above columns)

Classification	Budget at beginning of previous FY	Budget in FY89	Comparative gain/loss(Δ)	Ratio to previous FY
1. General account	* 140,925 340,410	* 135,642 355,442	*Δ 5,283 15,032	104.4%
2. Special account on industrial investment	4,700	4,400	Δ 300	93.6
3. Special account on power resources development pro- motion measures	* 79,410 95,083	* 37,311 106,781	*Δ 42,099 11,698	112.3
(1) Power resources location costs	15,032 * 79,410	18,642 * 37,311	3,610 *Δ 42,099	124.0 110.1
(2) Power resources diversification costs	80,051	88,139	8,088	
S&T Agency total	* 220,335 440,193	* 172,953 466,623	*Δ 47,382 26,430	106.0%

## Main Items

Unit: ¥1 million

(Note) Because figures are given in round numbers, totals do not necessarily agree with individual sums.

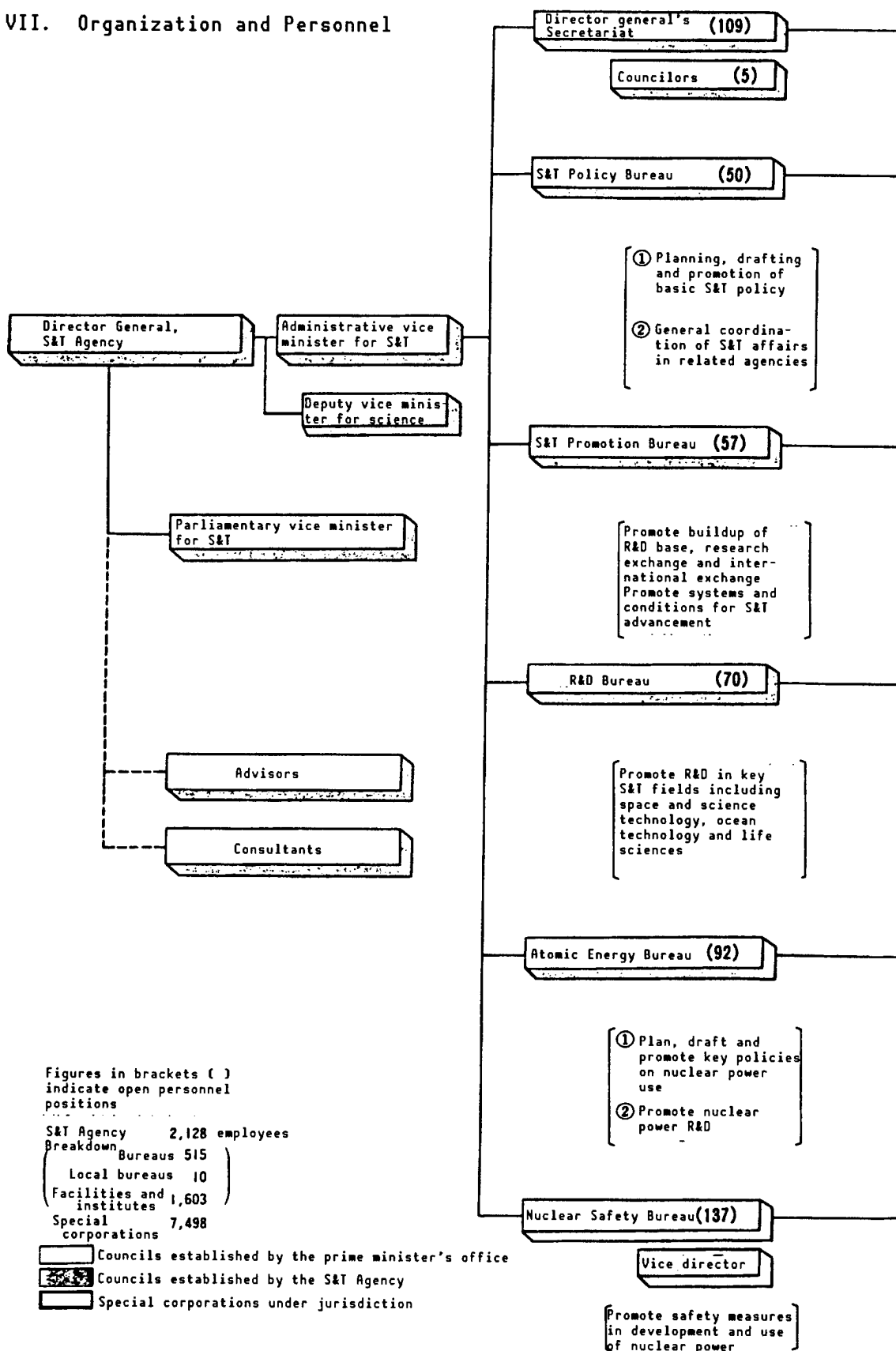
Item	1989 budget (1988 budget)	
1. Promotion of international S&T contribution	44,993	( 32,377)
• Promote Human Frontier Science Program [HFSP]	1,456	( 0
• Upgrade S&T-international exchange promotion system	418	0
• Active promotion of international cooperation projects	43,119	32,377
General account: ¥42.719 billion		
(¥31.891 billion), industrial investment		
Special account: ¥400 million (¥486 million)		
2. Upgrade creative and basic research	6,408	6,331
• Establish basic research special researcher system	106	0
• Expand creative S&T promotion system (three new themes: phase data, nuclear control surface, genome movement)	4,558	3,816
• Build International Frontier Research System	1,744	1,515
3. Build R&D base	11,045	9,972
• Promote regional S&T (high-level R&D promotion project)	311	132
• Promote large SOR facilities program	1,900	612)
• Promote industrial, academic and government research exchange	2,773	2,530)
• Promote S&T information exchange	6,257	6,769)
General account: ¥1.857 billion		
(¥2.069 billion), industrial investment		
Special account: ¥4.4 billion (¥4.7 billion)		
4. Overall promotion of S&T administration functions	10,693	9,653
• Expand S&T promotional and coordination funds (promote international fluid basic research)	10,100	9,200
• S&T Policy Research Institute	398	252
5. Promotion of nuclear R&D use and safety measures	281,643	271,490
General account: ¥174.862 billion		
(¥176.407 billion), power resources development promotional measures		
Special account: ¥106.781 billion (¥95.083 billion)		
• Establish and strengthen nuclear safety measures and nuclear nonproliferation	33,521	32,125
• Establish nuclear fuel cycle	52,245	50,375
• Promote new power reactor development	91,690	83,584

[continued]

[Continuation of Main Items]

Item	1989 budget (1988 budget)	
<ul style="list-style-type: none"> <li>• Promote lead projects:</li> <li>--Promote nuclear fusion R&amp;D</li> <li>  Including:</li> <li>    High functionalization of critical plasma test facility (JT-60)</li> <li>    Cooperate toward international thermo-nuclear fusion test reactor planning and design</li> <li>--Promote high-temperature engineering test reactor</li> <li>  Including:</li> <li>    Construction of high temperature engineering experimental reactor</li> <li>--Promote radiation use</li> <li>--Promote R&amp;D of nuclear ships</li> <li>• Strengthen measures to promote national understanding and cooperation</li> </ul>	46,777 23,118  4,884 1,711 4,171  820 15,941 4,347 18,981	46,372 23,756  1,128 1,747 4,222  0 11,075 7,313 15,318
6. Promote use of space development use <ul style="list-style-type: none"> <li>• Develop H-II rocket</li> <li>• Promote development research on earth observation platform technical satellite</li> <li>• Develop stationary weather satellite No 5</li> <li>• Comprehensive promotion of space station program</li> <li>--Participate in space station program (develop test module)</li> </ul>	109,062 35,557 311 179 6,203 2,966	98,470 34,333 542 197 8,344 6,436
7. Promote ocean development <ul style="list-style-type: none"> <li>• Develop a 6,000 meter-class diving research ship system</li> <li>• Regional joint R&amp;D on general-use ocean technology</li> </ul>	10,573 5,737 103	9,487 5,047 50
8. Promote R&D on earth S&T <ul style="list-style-type: none"> <li>• Promote R&amp;D on earth observation technology</li> <li>• Promote R&amp;D on disaster-prevention SAT</li> </ul>	30,121 27,380 2,624	17,651 15,083 2,568
9. Promote R&D on matter and material-related S&T <ul style="list-style-type: none"> <li>• Superconductive material-related S&amp;T (entire superconductivity research)</li> </ul>	13,066 3,114 3,945	11,171 2,044 3,192
10. Develop life sciences	15,614	12,809
11. Promote R&D on aeronautical technology <ul style="list-style-type: none"> <li>• R&amp;D on innovative air and space transport elemental technology (total with space included)</li> </ul>	7,914 1,528	8,710 664

## VII. Organization and Personnel



Figures in brackets ( ) indicate open personnel positions

S&T Agency 2,128 employees

Breakdown

Bureaus 515

Local bureaus 10

Facilities and institutes 1,603

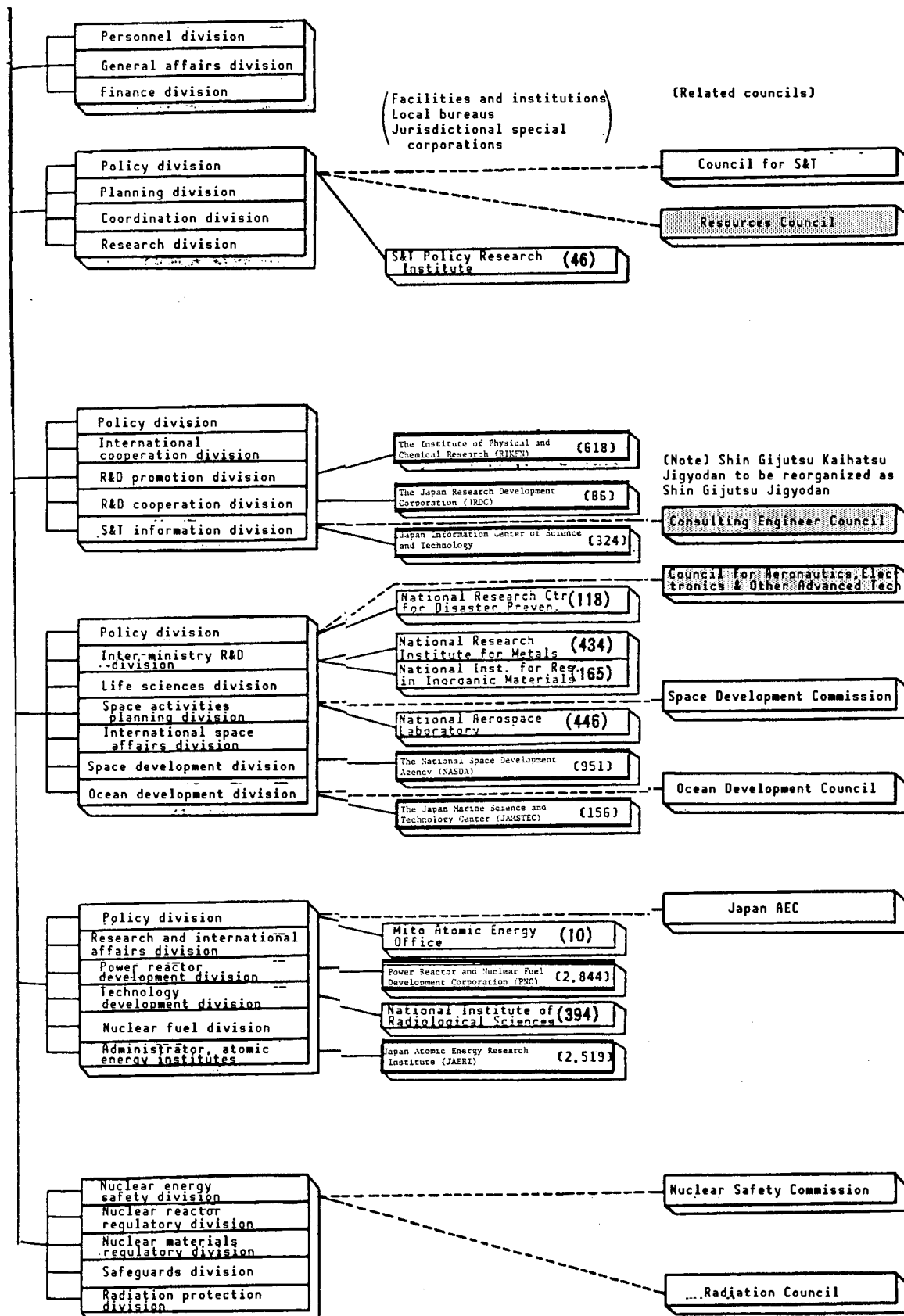
Special corporations 7,498

— Councils established by the prime minister's office

▨ Councils established by the S&T Agency

▬ Special corporations under jurisdiction

[Continuation of VII. Organization and Personnel]



# VIII. NATIONAL EXAMINATIONS

Examination	Content	Licenseses
Examination for consulting engineer	An engineer must pass the second-stage examination to be registered as a consulting engineer. He requires highly specialized ability and provides guidance in S&T planning, research, design, analysis, testing and evaluation. The position of an assistant consulting engineer is established to encourage young talent to become consulting engineers. An applicant is registered as an assistant consulting engineer after passing the first-stage examination. He is put under the guidance of a consulting engineer in the same field, and assists the consulting engineer.	Consulting engineers: 21,527 Assistant consulting engineers 2,137 (At end of January 1988)
Examination for chief engineer in charge of nuclear fuels	Under the nuclear reactor regulation law, operators of project processing and re-processing must select one chief engineer for each plant or project from the chief engineers licensed to handle nuclear fuels, to supervise safety in handling nuclear fuels. The license is issued by the S&T Agency director on the basis of a national examination.	549 (At end of January 1988)
Examination for chief engineer in charge of nuclear reactors	Under the nuclear reactor regulation law, parties establishing nuclear reactors must select one chief engineer for each reactor, from the chief engineers licensed to handle nuclear reactors, to supervise the safety of reactor operations. The license is issued by the S&T Agency director on the basis of a national examination.	684 (At end of January 1988)
Examination for chief engineer in charge of radiation	Under the radiation injury prevention law, project sites handling radioactive isotopes must select one chief engineer in charge of radiation to supervise prevention against radiation damage and injury. Licenses for chief engineers in charge of radiation are divided into three categories: Class 1, Class 2 (general) and Class 2 (equipment). In issuing licenses, Class 1 and Class 2 (general) licensees must complete a specific seminar at a designated institute. Class 2 (equipment) licensees must complete a separate seminar at a designated institute.	Class 1: 12,886 Class 2 (general): 20,149 Class 2 (equipment): 1,260 (At end of January 1988)

# IX. OUTLINE OF ADVISORY ORGANS

	Title	Duties	Date established
Advisory organs to prime minister	Council for S&T	As the highest deliberative organ in Japan for S&T policy, reports and advises as required on the following, and the prime minister must respect its views. •Establishes basic and overall policies on S&T in general. •Establishes long-term and comprehensive research goals. •Establishes key and necessary research to achieve research goals.	20 Feb 59
	Japan AEC	Conducts planning, deliberation and decision-making on systematic and democratic implementation of national policy on nuclear R&D use. The prime minister must respect its actions.	1 Jan 56
	Nuclear Safety Commission	Conducts planning, deliberation and decision-making concerning: •Regulatory policies to secure nuclear safety. •Safety regulation regarding nuclear reactors and nuclear fuel matter. The prime minister must respect its actions.	4 Oct 78
	Space Activities Commission	Plans, deliberates, makes decisions and expresses views on important policies concerning space development by individual institutions. The prime minister must respect its actions.	2 May 68
	Oceanographic Development Council	Investigates, deliberates and expresses views in reply to queries on basic and comprehensive matters pertaining to ocean development.	1 Jul 71
Advisory organs under S&T director general	National Institute of Resources	Replies to questions concerning important matters on comprehensive use of resources, and advises and reports as necessary.	19 May 56
	Consulting Engineer Council	In order to contribute to the sound growth of the consulting engineering system, investigates and deliberates on:	10 Aug 57

[continued]



[Continuation of IV. Outline of Advisory Organs]

Title	Duties	Date established
[Continuation of Consulting Engineer Council]		
	<ul style="list-style-type: none"> <li>•Important matters such as the consulting engineering system, and measures for the use of consulting engineers.</li> <li>•Cancellation of registration on consulting engineers and assistant consulting engineers</li> </ul>	
Council for Aeronautics, Electronics and Other Advanced Technologies	Deliberates on important matters concerning technology requiring comprehensive experimental research deemed necessary for cooperation among a plural number of sectors on aeronautics, electronics and other S&T. It replies to questions, and expresses views as necessary.	23 May 78
Other advisory organs	Radiation Council Based on the policy of controlling the radiation amount received by radiation-related workers and the general public below a harmful degree, and with the purpose of standardizing technology on prevention of radiation injury, the council replies to questions from heads of related administrative agencies and expresses views as necessary.	29 Jun 57

## X. OUTLINE OF INSTITUTIONS

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### National Aerospace Laboratory

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#### Purpose and duties:

In order to promote Japan's aeronautics and space science technology, it performs the following duties:

- (1) R&D on the fan-jet STOL plane.
- (2) Research on innovative air and space transport technology, the space transport system, space environment use, the satellite system and numerical simulation technology; also, experimental research on application in fields other than air and space technology.
- (3) Buildup and operation of large joint-use research facilities and equipment.

Address: 7-44-1 Jindaiji-Higashicho, Chofu City, Tokyo 182

Tel: (0422) 47-5911

Branches: Sumida branch (Kakuda City, Miyagi Prefecture),  
Chofu Airfield branch (Mitaka City, Tokyo),  
Gifu Flight Test Center (Kagamihara City, Gifu Prefecture)

Established: 11 July 1955

FY89 budget: ¥9,667,540,000

Number of employees (end of FY89): 446

Organization: Director.....Steering committee  
---Science researchers  
---STOL project promotion main office  
---Administrative department  
---Hydrodynamics department  
---Structural dynamics department  
---Thermal-fluid dynamics department  
---Mathematical analysis department  
---Aerodynamic performance department  
---Machine department  
---Motor department  
---Regulation department  
---Flight test department  
---New aircraft research group  
---Space research group  
---Kakuda branch  
---Guest researchers

[continued]

[Continuation of Outline of Institutions]

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National Research Institute for Metals

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Purpose and duties:

As the advisory research institute on metals, it performs the following duties:

(1) Basic research on development of new materials with high properties and performance, emphasizing unexplored domains.

(2) Secures reliability and safety of equipment and structures, and implements basic research to establish reliability of materials for upgrading of equipment and structures.

Address: 2-3-12 Naka-meguro, Meguro Ward, Tokyo 153

Tel: (03) 719-2271

Branch: Tsukuba branch (Tsukuba City)

Established: 1 July 1956

FY89 budget: ¥5,716,720,000

Number of employees (end of FY89): 434

Organization: Director.....Steering committee

- Science researchers
- Administrative department
- Basic properties research department
- Functional properties research department
- Material and design research department
- Reaction control research department
- System control research department
- Measurement and analysis research department
- Damage and organizational research department
- Environmental performance research department
- Research group No 3
- Research group No 4
- Research group No 5

Tsukuba branch: Branch director

- Administrative division
- Dynamic properties research department
- Surface phase control research department
- Research group No 1
- Research group No 2

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[continued]

[Continuation of Outline of Institutions]

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National Institute of Radiological Sciences

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Purpose and duties:

As the advisory research institute for radiological sciences in Japan, it performs the following duties:

- (1) Investigation and research in broad areas, including physics, chemistry, biology and medicine concerning the prevention of radiation injury to the human body.
- (2) Investigation and research concerning medical use of radiation, such as diagnosis of various diseases.
- (3) Training scientists and engineers in the above fields.

Address: 4-9-1 Anagawa, Chiba City 260

Tel: (0472) 51-2111

Branch: Nakaminato branch

Facility: Tokai facility

Established: 1 July 1957

FY89 budget: ¥10,559,900,000

Number of employees (end of FY89): 394

Organization: Director

- Science researchers
- Administrative department
- Physics research department
- Pharmaceutical physics and chemistry research department
- Biology research department
- Genetics research department
- Physiology and pathology research department
- Injury basic research department
- Internal explosion research department
- Environmental health research department
- Clinical research department
- Injury clinical research department
- Technical department
- Training department
- Hospital department
- General safety analysis and research department

Nakaminato branch:

- Administrative division
- Environmental radiation ecology research department
- Ocean radiation ecology research department[continued]

[Continuation of Outline of Institutions]

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National Research Center for Disaster Prevention

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Purpose and duties:

As the advisory research institute for disaster prevention S&T, it performs the following duties:

- (1) Testing and research concerning earthquake prediction, earthquake disaster prevention and abnormal weather disaster prevention.
- (2) Collection of data concerning disaster prevention S&T.
- (3) Buildup and operation of large joint-use test facilities.

Address: 3-1 Tennodai, Tsukuba City, Ibaraki Prefecture 305

Tel: (0298) 51-1611

Branches: Nagaoka snow/ice disaster prevention test/research institute  
Shinsho snow/ice disaster prevention test/research institute  
Hiratsuka snow/ice disaster prevention test/research institute

Established: 1 April 1963

FY89 budget: ¥2,618,250,000

Number of employees (end of FY89): 118

Organization: Director.....Steering committee

- Administrative department
- Research department No 1 (weather, water phenomena, urban disasters)
- Research department No 2 (earthquake prediction)
- Research department No 3 (earthcrust upheaval, earthquake disaster prevention)
- Research department No 4 (disaster measurement, data-processing, analysis of socioeconomic phenomena)
- Nagaoka Snow/Ice Disaster Prevention Institute
- Shinsho Snow/Ice Disaster Prevention Institute
- Hiratsuka Snow/Ice Disaster Prevention Institute
- Fluid researchers
- Guest researchers

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[continued]

[Continuation of Outline of Institutions]

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National Institute for Research in Inorganic Materials

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Purpose and duties:

As an institute for the promotion of research in the manufacture of nonmetal, inorganic materials of superhigh purity and other similar materials, performing a central role in Japan's research in inorganic materials, it contributes to development in inorganic materials necessary in the coming era.

Address: 1-1 Namiki, Tsukuba City, Ibaraki Prefecture 305

Tel: (0298) 51-3351

Established: 1 April 1966

FY89 budget: ¥2,792,040,000

Number of employees (end of FY89): 165

Organization: Director.....Steering committee  
---Research group No 1 ( $\text{ZrO}_2\text{-Mox}$ )  
---Research group No 2 ( $\text{M-Ta-S}$ )  
--- " " No 3 ( $\text{Si-C-N}$ )  
--- " " No 4 ( $\text{Bi-M-O-F}$ )  
--- " " No 5 ( $\text{M-Cu-O}$ )  
--- " " No 6 ( $\text{M}\cdot\text{S, Se, Te}$ )  
--- " " No 7 ( $\text{Ax<Ti, Ga>yO}_2$ )  
--- " " No 8 ( $\text{C}$ )  
--- " " No 9 ( $\text{Ln}_2\text{O}_3\text{-Al}_2\text{O}_3\text{-SiO}_2$  Glass)  
--- " " No 10 ( $\text{Ba}_2\text{NaNb}_5\text{O}_{15}$ )  
--- " " No 11 ( $\text{MxV}_6\text{O}_{15\text{n-m}}$ )  
--- " " No 12  
--- " " No 13 ( $\text{R}_3\text{M}_2\text{X}_3\text{O}_{12}$ )  
--- " " No 14 ( $\text{YFe}_2\text{O}_4$ )  
--- " " No 15 ( $\text{Al}_2\text{Si}_4\text{O}_{10}\text{<OH>}_2\cdot\text{nH}_2\text{O}$ )  
---Superhigh pressure station  
---Superhigh temperature station  
---Guest researchers

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[continued]

[Continuation of Outline of Institutions]

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S&T Policy Research Institute

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Purpose and duties:

As the core research institute for the buildup of a theoretical base to promote appropriate and effective S&T policies, it conducts theoretical, positive and systematic investigation and research on various matters that provide the foundation for evolvement of S&T policy.

Address: 1-11-39 Nagatacho, Chiyoda Ward, Tokyo 100

Tel: (03) 581-2391, 2392

Established: 1 July 1988

FY89 budget: ¥398,380,000

Number of employees (end of FY89): 46

Organization: Director.....Advisor

- General affairs research officer
- General affairs division
- Planning division
- Data systems division

(Theoretical research group

- Research group No 1
- Research group No 2

(Positive research groups)

- Investigation and research group No 1
  - Investigation and research group No 2
  - Investigation and research group No 3
  - Investigation and research group No 4
  - Guest researchers
- 

[continued]

[Continuation of Outline of Institutions]

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Japan Atomic Energy Commission

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1. Purpose and duties:

With the purpose of conducting comprehensive and effective research on nuclear energy development, it performs 1) basic research and application research on nuclear energy; 2) design, construction and operation of nuclear reactors; 3) R&D on nuclear ships; and 4) dissemination of the results of the above.

2. Address: 2-2-2 Uchisaiwaicho, Chiyoda Ward, Tokyo 100

Tel: (03) 592-2111

3. Branches: Tokai Institute, Nakagawa Institute, Takasaki Institute, Oarai Institute, Mutsu Business Office, Nuclear ship "Mutsu"

4. Established: 15 June 1956

5. FY89 budget: ¥104,737,790,000 (¥94,845,000,000 in national treasury outlay)

6. Number of employees (end of FY89): 2,519

7. Organization: Chairman (Board of directors)

- Planning office
- General affairs department
- Personnel department
- Finance department
- Business department
- Safety regulation office
- Nuclear fuel control office
- International cooperation office
- Technical information department
- Construction department
- Radio isotope/nuclear reactor training center
- Nuclear ship planning department
- Work cancellation preparatory office
- Nuclear ship R&D office
- Tokai Institute
- Nakagawa Institute
- Takasaki Institute
- Oarai Institute
- Mutsu Business Office
- Nuclear ship "Mutsu"

8. Capital: ¥919,540,680,000 (as of 31 March 1989)

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[continued]



[Continuation of Outline of Institutions]

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Japan Information Center for Science and Technology

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1. Purpose and duties:

As the core institute concerning S&T information in Japan, its purpose is to contribute to S&T development in Japan by providing S&T information at home and abroad with speed and accuracy.

2. Address: 2-5-2 Nagatacho, Chiyoda Ward, Tokyo 100  
Tel: (03) 581-6411

3. Branches: Information and Data Building, Information and Data Building/  
Tsukuba Data Center, Tsukuba branch, Hokkaido branch office,  
Tohoku branch office, Hokuriku branch office, Tokyo branch  
office, Nagoya branch office, Osaka branch office, Chugoku  
branch office, Shikoku branch office, Kyushu branch office

4. Established: 16 August 1957

5. FY80 budget: ¥12,859,960,000 (includes ¥6,250,000,000,000 in national  
treasury outlay)

6. Number of employees (end of FY89): 324

7. Organization: Board chairman  
---Managing director  
-----Directors  
---General affairs department  
---Accounting department  
---Information department  
Inspector ---Data department  
--Planning office ---Business department  
--Technology ---Electronic computer department  
management office ---Information and data department  
office ----Tsukuba Data Center  
---Tsukuba branch office  
-----Hokkaido branch office  
-----Tohoku branch office  
-----Hokuriku branch office  
---Tokyo branch office  
-----Nagoya branch office  
-----Osaka branch office  
-----Chugoku branch office  
-----Shikoku branch office  
-----Kyushu branch office

8. Capital: ¥36,656,490,000 (as of 31 March 1989)

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[continued]

[Continuation of Outline of Institutions]

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Institute of Physical and Chemical Research

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1. Purpose and duties:

The purpose of the Institute of Physical and Chemical Research is to create original and independent technology as follows: 1) experimental research at high levels from basics to application in a broad range of areas, including physics, chemistry, agriculture and biology; 2) achievements are disseminated to academic and industrial circles.

2. Address: 2-1-Hirozawa, Wako City, Saitama Prefecture 351-01

Tel: (0484) 62-1111

3. Business offices and branches: Life Sciences Tsukuba Research Center,  
Komazawa branch, Itabashi branch

4. Established: 21 October 1958

5. FY80 budget: ¥16,765,500,000 (including ¥16,056,000,000)

6. Number of employees (end of FY89): 618

7. Organization: Board chairman/vice chairmen/directors

---Planning office

---General affairs department

---Accounting department

----Research business department

---Facilities management department

---Development survey department

--International Frontier Research promotion department

----Safety control office

Inspector-----Life sciences cultivation biology department

----Life sciences research and information office

---Research base technology department

---Electronic computer office (plus 1 additional room)

---Research offices (41 research rooms)

---Laser science research group

---Solar photo-energy science research group

---International Frontier Research system

---Life Sciences Tsukuba Research center

(life sciences promotion department, six research  
rooms, gene bank room)

8. Capital: ¥84,789,110,000 (as of 31 March 1989)

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[continued]

[Continuation of Outline of Institutions]

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Research Development Corporation of Japan

(Name "Shin Gijutsu Kaihatsu Jigyodan" slated to be changed to "Shin Gijutsu Jigyodan" during FY89)

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1. Purpose and duties:

In order to develop new technology efficiently, perform basic research recognized as contributing to the creation of new technology, and to disseminate the fruits of such development and basic research, the corporation performs the following duties: 1) consign development of new technology (distribute development funds to corporate enterprises; commercialize research achievements that are difficult to commercialize); 2) conduct basic research through a fluid research system; 3) disseminate the fruits of (1) and (2); and 4) facilitate development of new technology.

2. Address: 2-5-2 Nagatacho, Chiyoda Ward, Tokyo 100

Tel: (03) 507-3001

3. Established: 1 July 1961

4. FY80 budget (excluding international portion): ¥11,578,440,000  
(includes ¥6,526,000,000 in national treasury outlay)

5. Number of employees (end of FY89): 81

6. Organization: Board chairman

---Managing director

--Directors

Inspector --General affairs department

--Development --Planning and investigation department

Council ---Project department

---Technology evolvement department

---Regulatory department

---Innovative S&T promotional project department

7. Capital: ¥44,482,640,000 (as of 31 March 1989)

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[continued]

[Continuation of Outline of Institutions]

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Power Reactor and Nuclear Fuel Development Corp.

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1. Purpose and duties:

It has a major role in virtually all leading development affairs concerning the nuclear fuel cycle. It promotes independent development of high-speed breeder reactors and new converter reactors, development of the nuclear cycle and reprocessing of spent fuels.

2. Address: 1-9-13 Akasaka, Minato Ward, Tokyo 107

Tel: (03) 586-3311

3. Business offices: Tokai business office, Oarai Engineering Center, Ningyo-toge business office, Chubu business office, high-speed breeder reactor "Monju" construction office, new converter reactor "Fugen" generating station

4. Established: 2 October 1967

5. FY80 budget: ¥232,970,480,000 (includes ¥144,678,000,000 in national treasury outlay)

6. Number of employees (end of FY89): 2,844

7. Organization: Board chairman

-----Assistant chairmen

---Directors

---Secretarial office

---Planning office

---Safety regulation department

---Nuclear matter control department

---Information office

---General affairs department

---Personnel department

Inspector-----Finance department

---Business department

Inspector's ---Technical cooperation department

office ---International department

---Power reactor technical development department

---Power reactor construction and operation main office

---Nuclear fuel cycle technical development department

---Nuclear fuel facilities planning department

---Environment technical development promotion main office

---Engineering construction office

---Nuclear fuel cycle engineering training office

---Tokai business office

---Oarai engineering center

---Chubu business office

---Ningyo-toge business office

---High-speed breeder reactor "Monju" construction office

---New converter reactor "Fugen" generating station

8. Capital: ¥1,537,114,830,000 (as of 31 March 1989)

[continued]

[Continuation of Outline of Institutions]

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National Space Development Agency

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1. Purpose and duties:

In order to contribute to promotion of space development and use for peaceful purposes, it performs the following functions, based on the basic program on space development designated by the prime minister: 1) development of artificial satellites and rockets to launch man-made satellites; 2) overseas launch and tracking of satellites and rockets.

2. Address: World Trade Building, 2-4-1 Hamamatsucho, Minato Ward, Tokyo 105

Tel: (03) 5470-4111

3. Branch offices: Tsukuba Space Center, Tanegashima Space Center, Katsuura Tracking Control Station, Okinawa Tracking Control Station, Ogasawara Tracking Station, Earth Observation Center, Rocket Development Center

4. Established: 1 October 1969

5. FY80 budget: ¥122,174,690,000 (includes ¥106,757,000,000 in national treasury outlay)

6. Number of employees (end of FY89): 951

7. Organization: Board chairman  
---Assistant chairmen  
---Accounting department  
---Finance department  
---Planning control department--Data systems office  
---Reliability control department  
---Safety control department  
---Investigation international department

Directors-----Space station development headquarters  
General ---Business promotion department  
affairs ---Space environment use group  
department ---Space station group  
---Rocket development main office  
---Main office  
---Engineering group  
---Rocket group  
---Artificial satellite development main office  
---Main office  
---Technical test satellite group  
---Earth observation satellite group  
---Communications and satellite broadcast group

[continued]

[Continuation of Outline of Institutions]

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[Continuation of National Space Development Agency]

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	---Councillors
	---Launch control department
	---Tracking control department
	---Katsuura tracking control station
	---Okinawa tracking control station
	---Facilities and equipment department
Inspector	
Inspection	---Tanegashima Space Center
office	---Masuda tracking control station
	---Tsukuba Center--Control office
	---Computation center
	---Development manager
	---System technical development department
	---Fuel and component development department
	---Testing department
	---Central tracking control department
	---Earth observation center
	---Kakuda rocket development center
	---Nagoya office
	---Ogasawara tracking station

8. Capital: ¥1,274,280,150,000 (as of 31 March 1989)

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[continued]

[Continuation of Outline of Institutions]

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Center for Marine S&T

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1. Purpose and duties:

In order to upgrade S&T concerning ocean development, performs the following duties: 1) comprehensive testing and research including R&D on deep-sea diving survey ships and R&D on diving operations technology; 2) upgrading and provision of large joint-use experimental research facilities; 3) provision of training and data-collecting services.

2. Address: 2-15 Natsujima-cho, Yokosuka City, Kanagawa Prefecture 237

Tel: (0468) 66-3811

3. Liaison office: Tokyo liaison office (03) 591-5151

4. Established: 1 October 1971

5. FY80 budget: ¥11,276,000,000 (includes ¥10,359,000,000 in national treasury outlay)

6. Number of employees (end of FY89): 156

7. Organization: Chairman

---Board chairman

--Directors

---General affairs department

--Planning and control office

Inspector

---Deep-sea research department

---Deep-sea development technology department

---Navigation department

---Ocean development and research department

---Diving technology department

--Training office

---Counselors

---Information office

8. Capital: ¥57,286,190,000 (as of 31 March 1989)

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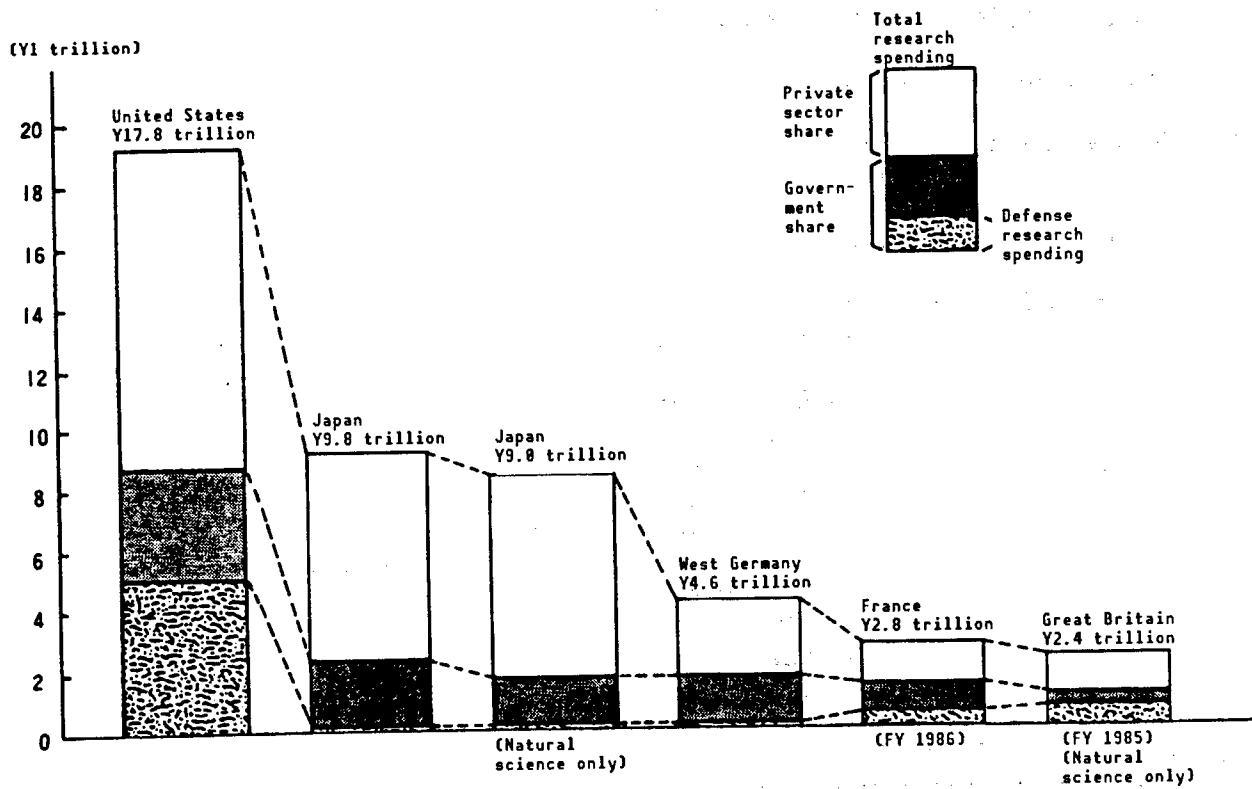
# XI. R&D INVESTMENT IN JAPAN AND OTHER PRINCIPAL NATIONS

## • Japan's R&D Investment (Natural Sciences)

(Unit: ¥100 million, percent)

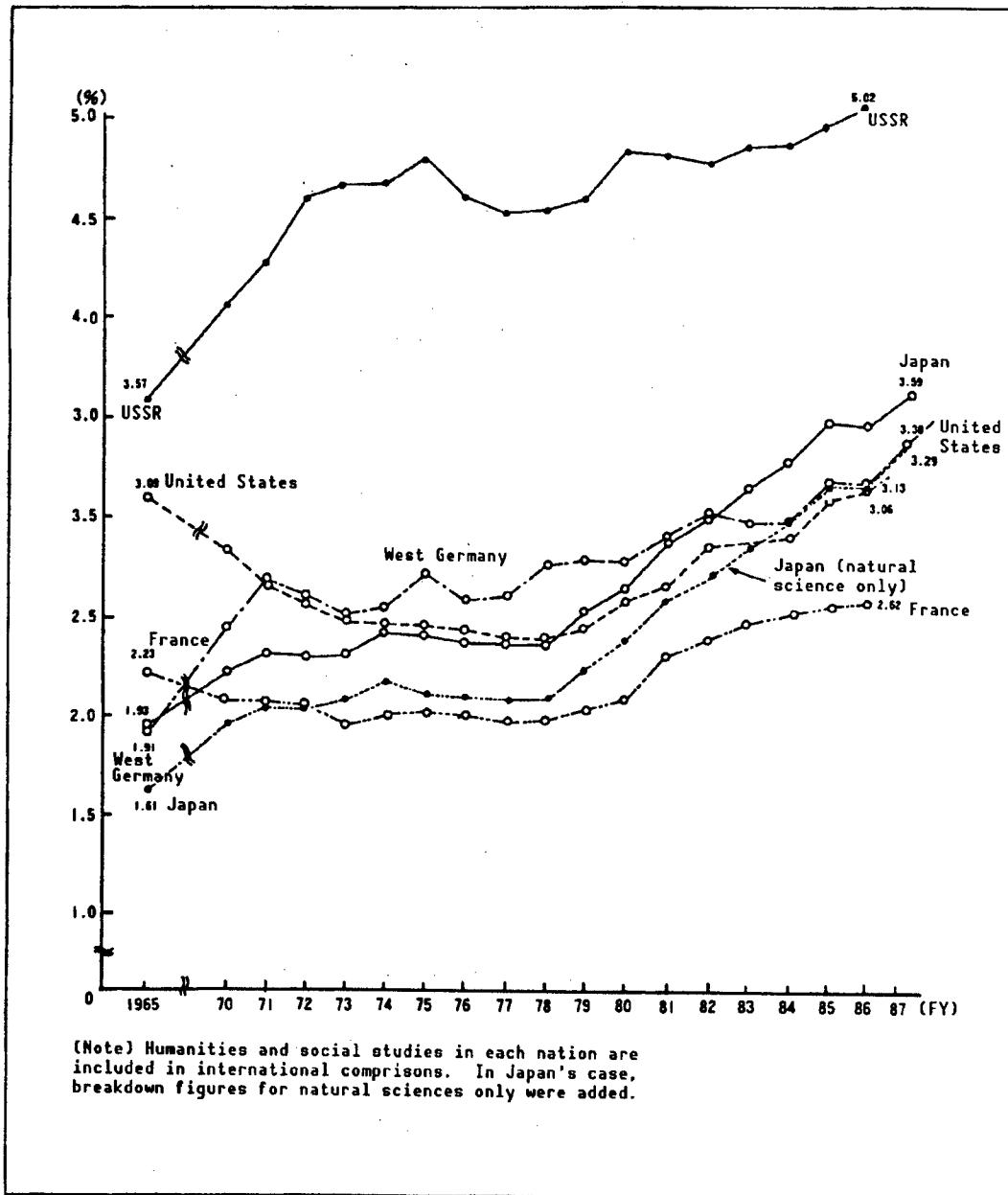
Fiscal year	1965	1970	1975	1980	1981	1982	1983	1984	1985	1986	1987
Total research costs	4,258	11,953	26,218	46,838	53,640	58,815	65,037	71,765	81,164	84,150	90,162
Government share	1,311	3,014	7,208	12,096	13,403	13,888	14,407	14,945	15,740	16,517	17,983
Ratio to national income	1.61	1.96	2.11	2.35	2.58	2.71	2.85	2.99	3.19	3.18	3.29

## • R&D Investment of Principal Nations (FY87)





- Shift in Ratio of Research Spending to National Incomes in the Principal Nations



## XII. HISTORY OF SCIENCE AND TECHNOLOGY AGENCY

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1955

- 31 May Resolution by Lower House Commerce and Industry Committee's S&T development subcommittee to establish the S&T Agency
- 11 Jul The National Aeronautical Laboratory (Prime Minister's Office) is inaugurated
- 5 Dec First special committee for S&T development policy is established by the 23rd Extraordinary Diet
- 19 Dec Partial revision (concerning establishment of the Atomic Energy Bureau) of the Atomic Energy Basic Law, the Atomic Energy Commission Establishing Law and the Law on Establishment of the Prime Minister's Office (enacted 1 January 1956) is announced

1956

- 31 Mar The Science and Technology Agency Establishment Law (enacted 19 May) is announced
- 19 May The Science and Technology Agency is inaugurated  
The National Aeronautical Council is reorganized and makes a new start
- 15 Jun The Atomic Energy Research Institute is inaugurated
- 1 Jul The National Research Institute for Metals is inaugurated
- 10 Aug The Japan Atomic Fuel Corp. is inaugurated

1957

- 20 May The Consulting Engineer Law (enacted 10 August) is announced
- 10 Jun The Law on Prevention of Radiation Injury from Radioactive Isotopes (enacted 1 April 1959) is announced  
The Law on Control of Nuclear Raw Materials, Nuclear Fuel Matter and Nuclear Reactors (enacted 9 December 1957) is announced
- 29 Jun The Radiation Council is established
- 1 Jul The National Institute of Radiological Sciences is inaugurated  
The Atomic Energy Research Institute, the Tokai Research Institute and the Radio-Isotope Training Center are inaugurated
- 16 Aug The Japan Information Center of Science and Information is inaugurated

[continued]

[Continuation of XIV. History of Science and Technology Agency]

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1958

- 14 May The Electrotechnical Council is established
- 21 Oct The Institute of Physical and Chemical Research is reorganized and makes a new start

1959

- 20 Feb The Council for Science and Technology is established
- 3 Apr The Atomic Energy Research Institute and the Atomic Reactor Training Center are inaugurated
- 4 Apr The Planning Bureau and the Development Bureau are established (The Planning and Coordination Bureau and the Investigation and Propagation Bureau are abolished)

1960

- 16 May The National Space Activities Council is established (The Preparatory Committee for Space S&T Development is eliminated)

1961

- 20 Apr The Council for Marine Science and Technology is established  
The Law on Compensation for Atomic Injury and the Law on Atomic Energy Compensation and Indemnity Bonds (enacted 15 March 1962) are announced
- 1 Jul The Research Development Corporation of Japan is inaugurated
- 1 Dec The Tokai branch of the National Institute of Radiological Sciences opens

1962

- 25 Apr The Research Coordination Bureau is established

1963

- 1 Apr The National Research Center for Disaster Prevention opens
- The National Aeronautical Laboratory is renamed as the National Aerospace Laboratory
- 17 Aug The Japan Nuclear Ship Development Agency opens
- 1 Oct The Mito Atomic Energy Office opens

[continued]

[Continuation of XIV. History of Science and Technology Agency]

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1964

- 1 Jul The National Space Development Center is opened
- 16 Dec The Snow Injury Experimental Research Institute of the National Research Center for Disaster Prevention is inaugurated

1965

- 1 Jul The Kakuda branch of the National Aerospace Laboratory opens

1966

- 1 Apr The National Institute for Research in Inorganic Materials opens
- 24 May The Tanegashima Space Center is established and approved by the Cabinet

1967

- 1 Apr The Oarai Laboratory of the Atomic Energy Research Institute opens
- 10 Jun The Hiratsuka branch of the National Research Center for Disaster Prevention opens
- 2 Oct The Power Reactor and Nuclear Fuel Development Corp is inaugurated  
(The Nuclear Fuel Corp. is abolished)

1968

- 1 Feb The National Space Development Center, the Katsuura Radiowave Tracking Station and the Okinawa Radiowave Tracking Station start operations
- 2 May The Space Activities Commission is established  
(The National Space Activities Council is abolished)
- 15 Jun The National Institute of Resources is established  
(The Resources Bureau is abolished)

1969

- 1 Oct The National Space Development Agency is inaugurated  
(The National Space Development Center is abolished)  
The Shinsho branch of the National Research Center for Disaster Prevention opens

1970

- 1 Mar The Oarai Engineering Center of the Power Reactor and Nuclear Fuel Development Corp. opens

[continued]

[Continuation of XIV. History of Science and Technology Agency]

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1971

- 1 Jul The Oceanographic Development Council is established  
(The Council for Marine Science and Technology is abolished)
- 1 Oct The Center for Marine Science and Technology starts operations

1972

- 1 Mar The National Institute for Research in Inorganic Materials is transferred to Tsukuba New Town
- 1 Jun The National Space Development Agency's Tsukuba Space Center opens

1973

- 1 Mar The National Research Center for Disaster Prevention's Iwatsuki Earthcrust Activity Observation Facility opens

1974

- 1 May The Institute of Physical and Chemical Research's life sciences promotion department is established
- 6 May The Law on Regional Upgrading of Environs of Power Generating Facilities (enacted 20 August) is announced  
The Power Generation Development Promotional Law (enacted 1 October) is announced  
The Law on the Special Account for Power Generation Promotional Policies (enacted 1 October) is announced

1975

- 5 Aug The Nakaminato branch of the National Institute of Radiological Sciences opens

1976

- 16 Jan The Nuclear Safety Bureau is established
- 29 Oct The Earthquake Prediction Promotional Bureau is established within the Cabinet

1977

- 12 Sep The Japan-U.S. joint decision on operation of the Tokai reprocessing facility is announced

[continued]

[Continuation of XIV. History of Science and Technology Agency]

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1978

27 Feb The Research Exchange Center at Tsukuba Research New Town is opened for business

23 May The Council for Aeronautics, Electronics and Other Advanced Technologies is established  
(The National Aeronautical Council and the Electrotechnical Council are abolished)

7 Jun The Atomic Energy Basic Law is partially revised

4 Oct The Nuclear Safety Commission is established

1979

4 Jan Consistency in atomic energy control administration is promoted

29 Jan The Earth Observation Center of the National Space Development Agency begins operations

20 Mar The Tsukuba branch of the National Research Institute of Metals is established

27 Nov The Cabinet approves a request to hold the International Exhibition on Science and Technology

1980

29 Nov The Japan Nuclear Ship Development Agency is reorganized as the Japan Nuclear Ship R&D Agency

1981

1 Apr The Science and Technology Development and Coordination Award is established

1 Oct The Creative S&T Promotional System is established

1982

4-6 May The Eighth Summit conference of principal nations is held, and international cooperation in S&T is placed on the agenda

14 May The Cabinet approves construction of the high-speed breeder reactor "Monju"

1983

20 Apr The Consulting Engineer Law is totally revised

20 Jun The three space treaties are ratified

1-2 Dec The Japan-ASEAN S&T-related ministerial conference is held

[continued]

[Continuation of XIV. History of Science and Technology Agency]

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1984

27 Nov The Council for Science and Technology replies to a question (No 11) on "comprehensive basic measures on S&T development, from a long-term viewpoint to cope with new circumstances"

1985

17 Mar~ The International Science and Technology Exhibition is held  
16 Sep

31 Mar The Japan Nuclear Ship R&D Agency is integrated with the Japan Atomic Energy Research Institute

1986

28 Mar A Cabinet decision is made concerning the Science and Technology Outline

20 May The Research Exchange Promotion Law (enacted 19 November) is announced

1 Jul The S&T Policy Bureau, the S&T Development Bureau and the R&D Bureau are established  
(The Planning Bureau, the Research Coordination Bureau and the Development Bureau are abolished)

1 Oct The Institute of Physical and Chemical Research's International Frontier Research System is inaugurated

1987

8-10 Jun The Human Frontier Science Program [HFSP] is included in the Venice Summit's economic declaration

1988

1 Jul The National Institute for S&T Policy Research is established  
(The National Institute of Resources is abolished)

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